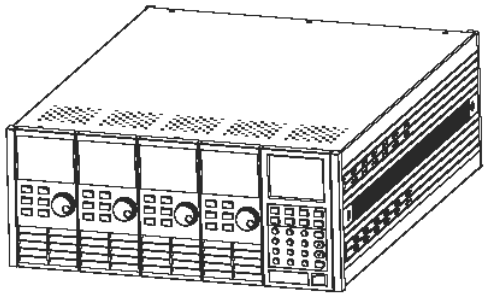
USER'S GUIDE

Programmable DC Electronic Load

Models IT8700 series



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Warranty Information

Certification

We certify that this product meet its published specifications at time of shipment from the factory.

Warranty

This hardware product is warranted against defects in material and workmanship for a period of ONE year from date of delivery. IT8700 series electronic load for use with a hardware product and when properly installed on that hardware product, are warranted not to fail to execute their programming instructions due to defects in material and workmanship for a period of 90 days from date of delivery. During the warranty period our company will either repair or replace products which prove to be defective. Our company does not warranty that the operation for the software firmware or hardware shall be uninterrupted or error free.

For warranty service, with the exception of warranty options, this product must be returned to a service facility designated by our company. Customer shall prepay shipping charges by (and shall pay all duty and taxes) for products returned to our place for warranty service. Our company shall pay for return of products to Customer.

Limitation of Warranty

The foregoing warranty shall not apply to defects resulting from improper or inadequate maintenance by the Customer, Customer-supplied software or interfacing, unauthorized modification or misuse, operation outside of the environmental specifications for the product, or improper site preparation and maintenance.

Assistance

The above statements apply only to the standard product warranty. Warranty options product maintenance agreements and customer assistance agreements are also available.

Safety Summary

The following general safety precautions must be observed during all phases of operation of this instrument. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the instrument .We assumes no liability for the customer’s failure to comply with these requirements.

Environmental Conditions

This instrument is intended for indoor use. Pollution degree 2 environments. It is designed to operate at a maximum relative humidity of 95% and at altitudes of up to 2000 meters. Refer to the specifications tables for the ac mains voltage requirements and ambient operating temperature range.

Before Applying Power

Verify that all safety precautions are taken. Note the instrument's external markings described under "Safety Symbols".

Ground the Instrument

This product is a Safety Class 1 instrument (provided with a protective earth terminal). To minimize shock hazard, the instrument chassis and cover must be connected to an electrical ground. The instrument must be connected to the ac power mains through a grounded power cable, with the ground wire firmly connected to an electrical ground (safety ground) at the power outlet. Note: Any interruption of the protective (grounding) conductor or disconnection of the protective earth terminal will cause a potential shock hazard that could result in personal injury.

DO NOT OPERATE IN AN EXPLOSIVE ATMOSPHERE

Do not operate the instrument in the presence of fumes or flammable gases.

KEEP AWAY FROM LIVE CIRCUITS

Operating personnel must not remove instrument covers except as instructed in this Guide for installing or removing electronic load modules. Component replacement and internal adjustments must be made only by qualified service personnel. Do not replace components with power cable connected. Under certain conditions dangerous voltages may exist even with the power cable removed. To avoid injuries always disconnect power, discharge circuits, and remove external voltage sources before touching components.

DO NOT SERVICE OR ADJUST ALONE

Do not try to do some internal service or adjustment unless another person capable of rendering first aid resuscitation is present.

Safety Symbols

Direct current

Alternating current

Both direct and alternating current

Protective earth (ground) terminal

Caution (refer to accompanying documents)

WARNING

The WARNING sign denotes a hazard. It calls attention to a procedure, practice, or the like, which, if not correctly performed or adhered to, could result in personal injury. Do not proceed beyond a WARNING sign until the indicated conditions are fully understood and met.

CAUTION

The CAUTION sign denotes a hazard. It calls attention to an operating procedure, or the like, which, if not correctly performed or adhered to, could result in damage to or

destruction of part or all of the product. Do not proceed beyond a CAUTION sign until the indicated conditions are fully understood and met.

Introduction

IT8700 DC electronic loads are multichannel programmable electronic loads. With RS232 /GPIB /USB/ EtherNet communication interfaces, the series DC electronic loads can provide multi solution according to the requirements of your design and test. IT8700 DC electronic loads provide you with the flexibility to test a wide range of applications from multi-output AC/DC power supply, DC/DC converter, charger to power electronic components. It is configured by plugging the user selectable modules into the mainframe, and operated using the keypad and rotary knob on the front panel or the remote controlled instructions via Ether Net, USB, RS-232C or GPIB interface. The high resolution voltage(0.1mV), current(0.01mA) measurement system(Up to 1k Hz sampling) provides both accuracy and convenience. User can simulate a wide range of dynamic loading (Up to 25K Hz) applications. The loading waveform is user programmable in slew rates, load levels, duration and conducting voltage.

- Removable channels: increase system flexibility
- Dynamic Power distribution function for dual channels, save your cost
- Dual-channel module can display every channel information simultaneously with no need to switch
- Measure peak current in short-circuit
- Transient mode: Up to 25KHZ; List mode : 100KHZ
- Measurement resolution: 0.1mV,0.01mA
- Measurement speed: up to 1KHZ
- A unit with single mainframe can take up to 8 channels, with extended mainframe up to 16 channels
- Adjustable slew rate
- Support several electronic loads working at the same time
- Auto-test function
- Output resolution up to 16 bits ,voltmeter and ammeter reach 5 1/2 digits
- Constant current(CC),constant voltage(CV),constant resistance(CR) mode
- Highlight VFD display for both mainframe and load modules
- Support USBTMC/SCPI communication protocol
- Output terminals on the rear panel make wiring easy and keep front panel clean
- Simulate the transient response and export measured values in time
- Built-in waveform generator and LIST mode
- Ethernet ,GPIB ,USB ,RS232 interfaces

Chapter 1 Products Introduction

1.1 Introduction

This user's manual introduces the specifications, installation, operation and programming of IT8700 series DC electronic loads. There're two parts in IT8700 DC electronic loads, mainframe/ extended frame and modules. The frames mentioned are IT8702 mainframe and IT8703 extended frame. Modules refered to are IT8711、IT8712、IT8731、IT8732、IT8732B、IT8733、IT8733B、IT8722 and so on. The range of every module's specific voltage, current and power will be introduced in the specifications in detail.

1.2 Description

The dimension of IT8702 is same as that of IT8703.The difference is that IT8702 is four modules control unit while IT8703 is a extended unit. There are up to 8 channels in IT8702 mainframe. After extended with IT8703 mainframe,it can be up to 16 channels. All panel operation and programming are also carried on the IT8702 main panel.

One module could have one or two channels,each module will have its own channel number according to the slot position.In the case of IT8702 mainframe,if each slot has one channel,then the channel number from right to left should be:1th channel,3th channel,5th channel….For module with dual channels,the channel number should be:1th and 2th channels,3th and 4th channels,5th and 6th channels….IT8703 extended mainframe can be understanded in the same way.

Modules IT8711、IT8712 have the same menu functions.IT8731、IT8732、IT8732B、IT8733、IT8733B、IT8732 are with the same menu functions.The difference is in the range of input voltage,current and power.Following are the similarities and differences of menu functions between IT8711's and IT8731's.

Module IT8711、IT8712:

- Working functions:constant current mode(CC),constant resistance(CR),constant voltage(CV)
- Enable you to set the rising slope and falling slope of current,voltage or resistance in dynamic mode,dynamic functions has three modes:CC,CV or CR
- CV mode has no high and low range selections
- Dynamic mode:up to 25KHZ,list mode:up to 100KHZ
- Voltage measuring resolution:0.1mV,0.01mA,measuring speed could reach 1KHZ
- With remote sense function
- Short-circuit function
- Storage capacity:101 sets
- List mode:enable you to edit a list file in CC,CV or CR mode.step range: 2-255,each step time:0.000001~16383s.You can save six list files.
- Autotest function:enable you to edit 10 files at most,each file will have 10 steps

Module IT8731,IT8732,IT8732B,IT8733,IT8733B,IT8722

- Working functions:constant current(CC),constant resistance(CR),constant voltage(CV),constant power(CW),constant impedance(CZ)
- Enable you to set the rising slope and falling slope of current in dynamic mode,dynamic functions has one mode:CC
- Dynamic mode:up to 25KHZ,list mode:up to 100KHZ

- Voltage measuring resolution:0.1mV,0.01mA,measuring speed could reach 50KHZ
- With remote sense function
- Short-circuit function
- Storage capacity:101 sets
- List mode:enable you to edit a list file in CC mode.number of list steps: 2-84,each step time:0.000020~3600s.You can save seven list files.
- CR-LED function

1.3 Front panel description

There're two parts in front panel,which are main panel and module panel. Please read figure 1-1 for details. Main panel and module panel keys' function will be introduced below.

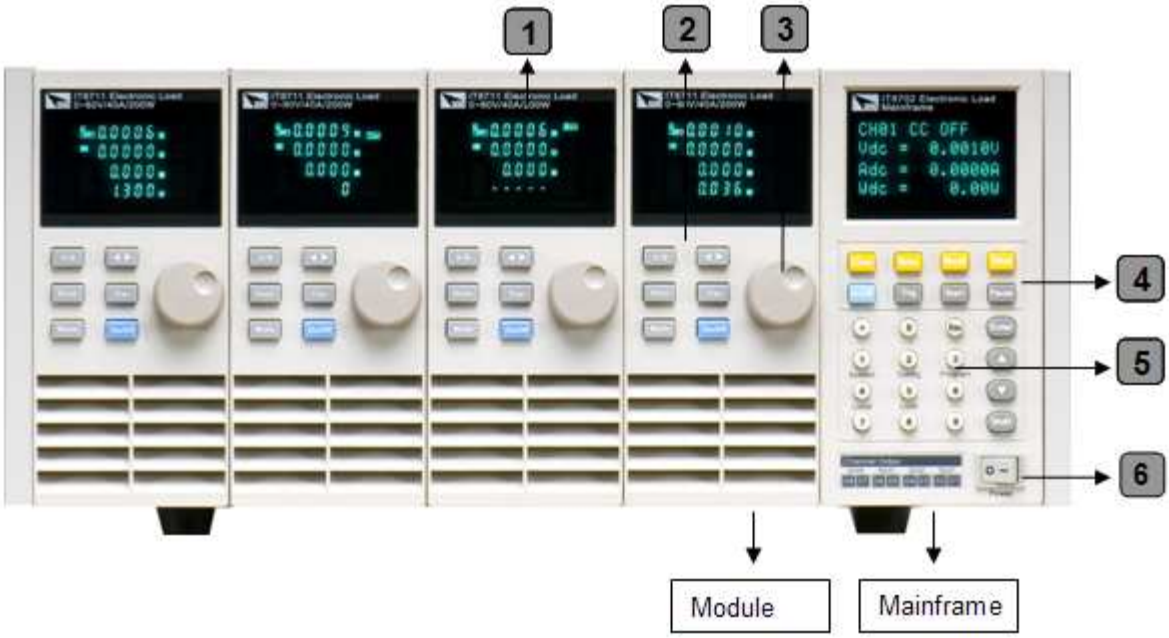


Figure 1-1 IT8700 front panel

1. VFD display
2. Module keyboard: <A/B>,<Short>,<Tran>,<Mode>,<On/Off> and direction keys.
3. Adjustment knob,change parameters
4. Mainframe function keyboard: control each channel's operating status. specific buttons: <Chan>, <Save>, <Reall>, <Setup>, <On/Off>, <Trig>, <Start>, <Pause>, <Enter>, <Shift>, <▲>, <▼>.
5. Mainframe compound button(（numeric keys）:1.set parameters 2.assembled menu function.detailed buttons:<1>,<2>,<3>,<4>,<5> plus function keys to enter the system menu, <6> plus function keys to enter the config menu,<7> plus function keys to enter program menu,<8> plus function keys to select local operation, <9> plus function keys to select lock function,<0>,<.>.
5. Power switch ON/OFF

1.4 Rear panel description

The part introduces the location of terminals and interfaces on the rear panel. see figure 1-2 for more details.

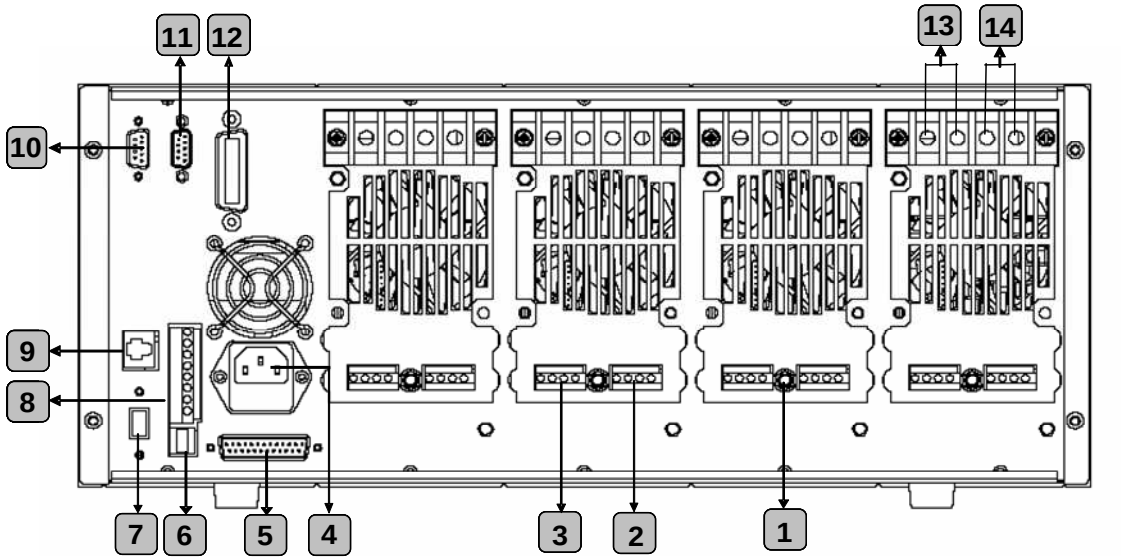


Figure 1-2 IT8700 rear panel

1	Current monitoring terminal
2	Remote sense and external input control terminal
3	Digital I/O and VF output signal teminal
4	Power input socket
5	Extended module interface
6	USB communication cable interface
7	Line voltage slection switch（110V/220V）
8	Trigger input /output and ON/OFF input/output interface
9	Network interface
10	9-pin COM port interface connector（RS232 communication cable interface）
11	9-pin COM serial port connector（extended keyboard interface ）
12	GPIB interface
13	Positive input terminal of module
14	Negative terminal of module

Chapter 2 Inspection and installation

This chapter will introduce the acceptance items after you receive the new unit.

2.1 Inspection

Please confirm whether the outer box is good,then broke open the packing cases to see if there is any damage caused in the transportation.Simultaneously,make sure the following standard accessories are not missing.If any is missed,please contact with the most nearest available distributors.

Take one unit as a reference:

- One power line
- One user's manual
- One delivery inspection report

2.2 Clean

If you want to clean the outer cover of the unit,please wipe with a dry or moistish cloth.Do not clean the unit's internal part randomly.

Caution: Make sure you have cut off the electricity supply before you start the cleaning.

2.3 Module installation

Cautions:

Franklinism will damage the module.Please install the module according to standard electostatic prevention operation style.Avoide touching the circuit board and connectors.

Installation steps:

- Turn off the power switch and disconnect the 110V/220V power cord.
- Take off any packing materials around the mainframe.
- Push the module into the slot(as shown in fingure 2-1)
- Fix the module with a screwdriver,the position of the screw is in the upside and backside of the machine frame.
- Install other modules one by one

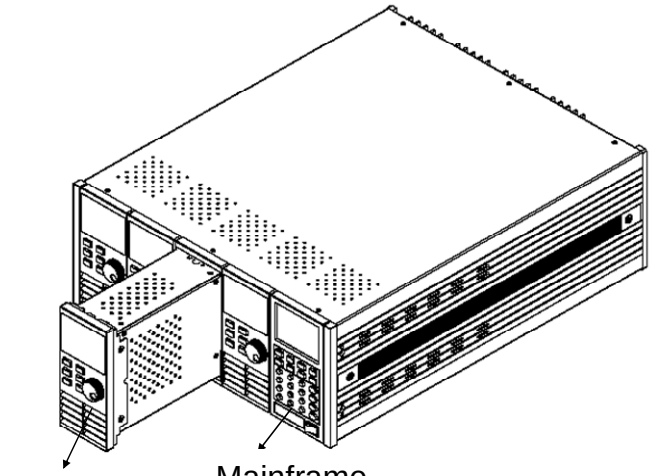


Figure 2-1 module installation

2.3.1 Channel number

To IT7800, the channel number for all modules is determined by the location of the modules in relation to right side of the mainframe. To IT8702 mainframe,the total channel number is 8. the 1st & 2nd channel are always next to the mainframe while 7,8 channels are always next to the left side. Load channel number is fixed even if the location isn't occupied. Double-channel module has two channels, e.g IT8722. If it's single channel module,the channel number is automatically assigned the first number of the slot. The following picture show the channel number default order.

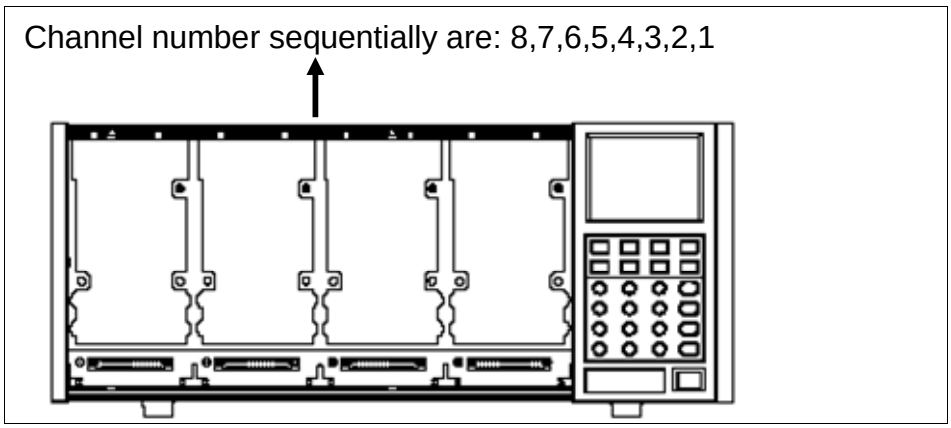


Fig 2-2A channel number distribution

For example: If IT8702 mainframe contains two single channel modules IT8711and two double channels modules IT8722. Channel number is automatically assigned to every channel at the sequence from right to left:1,3,5,6,7,8. Now channel number 2,4 aren't occupied.You can base on your test request to configure the modules(single module:IT8711,IT8712,IT8731,IT8732,IT8732B,IT8733,IT8733B;double module:IT8722).

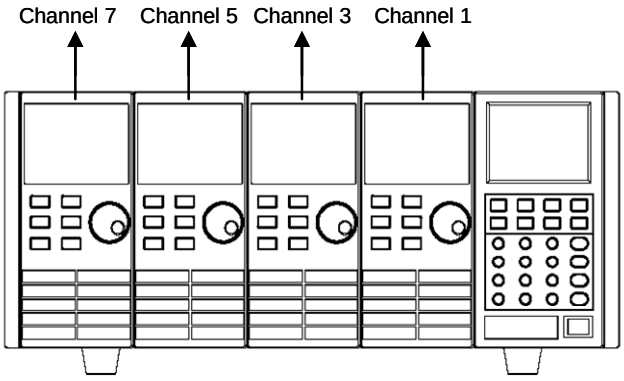


Fig 2-2B channel number order while installing 4 single-channel unit

2.4 Mainframe installation

The operating temperature of IT8700 series electronic load is 0 to 40℃. A fan cools the electronic load by drawing air through the top and sides and exhausting it out the back. The electronic load must be installed in a location that allows sufficient space at the sides and back of the unit for adequate air circulation. Minimum clearances for bench operation are 3cm on the top. If there are radiator fan in your cabinet,please avoid installing the load near the fan for cabinet fan limiting air circulation of load. If you are installing equipment on top of your electronic load in the cabint,use a filler panel above the unit to ensure adequate for air circulation.

IT8700 series can be mounted in a standard 19-inch rack panel r cabinet. When it's mounted,there's no need to remove the bottom studs. You can achieve it use IT-E153(optional).

CAUTION:

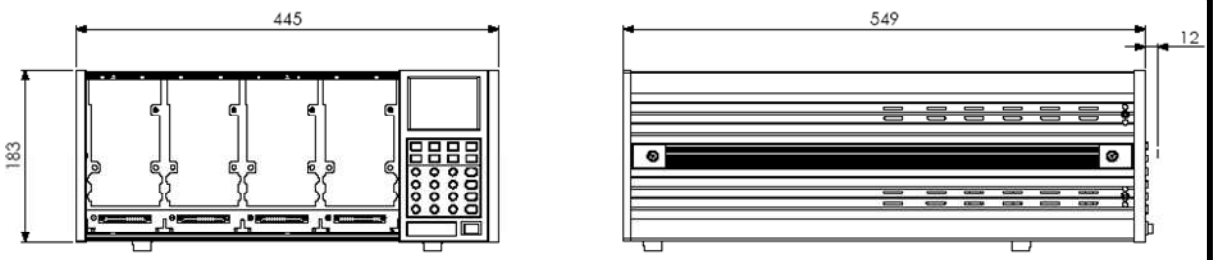
Do not block the fan exhaust at the rear of the Load

When the load uses on the desk ,make sure there enough space on the bottom of the equipment for air circulation.

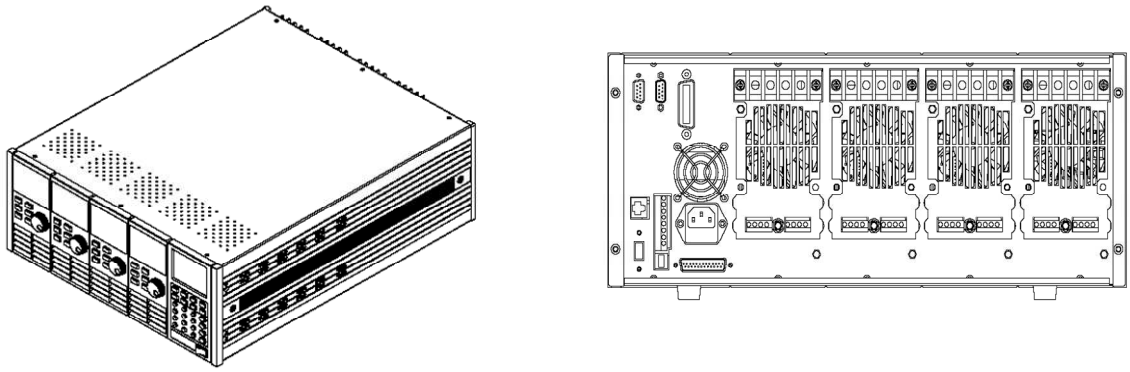
2.4.1 Installation

Mainframe dimension: 445 mmW x 183mm H x 549mm D

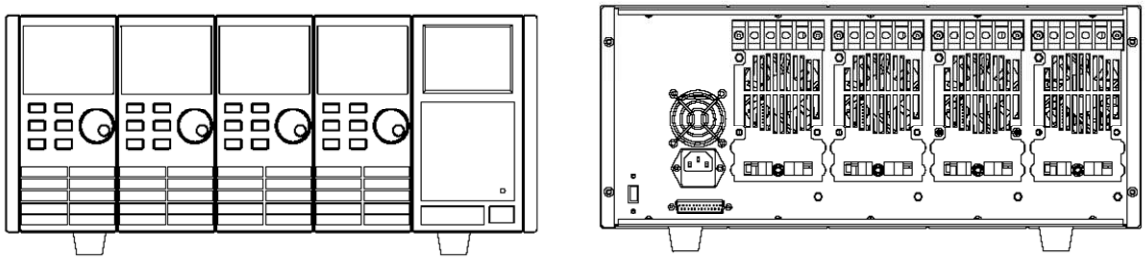
The outline diagram in fig 2-4 gives the dimensions of the electronic loads:



IT8702 mainframe size



IT8702 installation figure



IT8703 Extended mainframe installation figure（dimension is same as IT8702）

unit: milimeter（mm）

figure2-3A IT8702 and IT8703 outline diagram

Figure 2-4 IT8702 and IT8703 dimensioned drawing

Module dimension: 82 mmW x 183mm H x 549mm D（IT8711/IT8712/IT8722）
The outline diagram in figure 2-5 gives the dimensions of module.

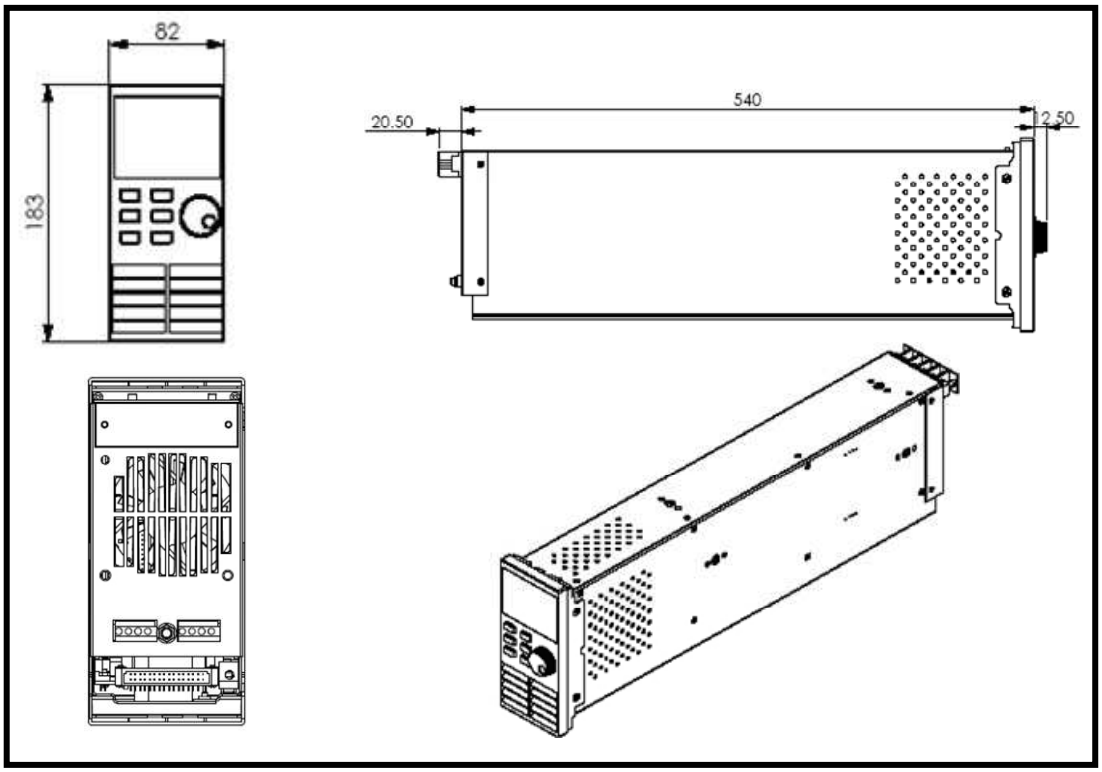
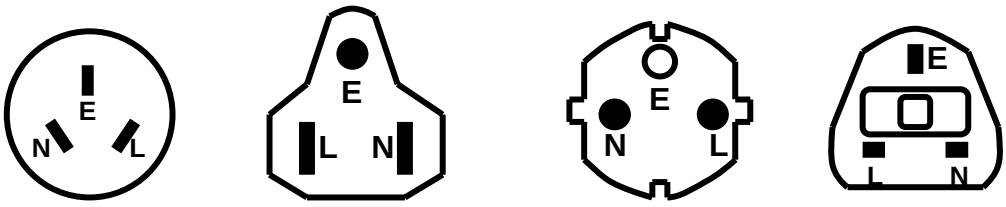


Fig 2-5 module outline diagram

Chapter 3 Power-on check

3.1 Power cord configuration

Connect the correct power cord to the connector on the rear panel of the load. Please select the line voltage type of your region from the power cord below. If the wrong power cord was shipped,contact your nearest vendor of us.



CHINA **USA，Canada** **Europe** **England**

IT-E171 IT-E172 IT-E173 IT-E174

（L: Live or Active Conductor(also called “live” or “hot”; N: Neutral or identified conductor; E: Earth or Safety Ground）

Figure 3-1 types of power cord

Item	Part Number	Description
Power cord	IT-E171	you can choose difference power line according to regions
	IT-E172	
	IT-E173	
	IT-E174	
Users'manual		including installation ,operation,self-test information
Software CD		programming software，technical information and communication protocol
Test report		test report before ex-factory

3.2 Input voltage selection

The load can work under 110/220V±10%AC input,as the label shown on the rear（refer to figure 3-2）. If the default value on the label doesn't match your region's, please switch the black key to choose input line voltage,and then insert power cord. Choose the right linear voltage as following.

CAUTION:

Thre's no need to change fuse when linear voltage changes. The fuse can protect the electronic load at any setting voltage specified.

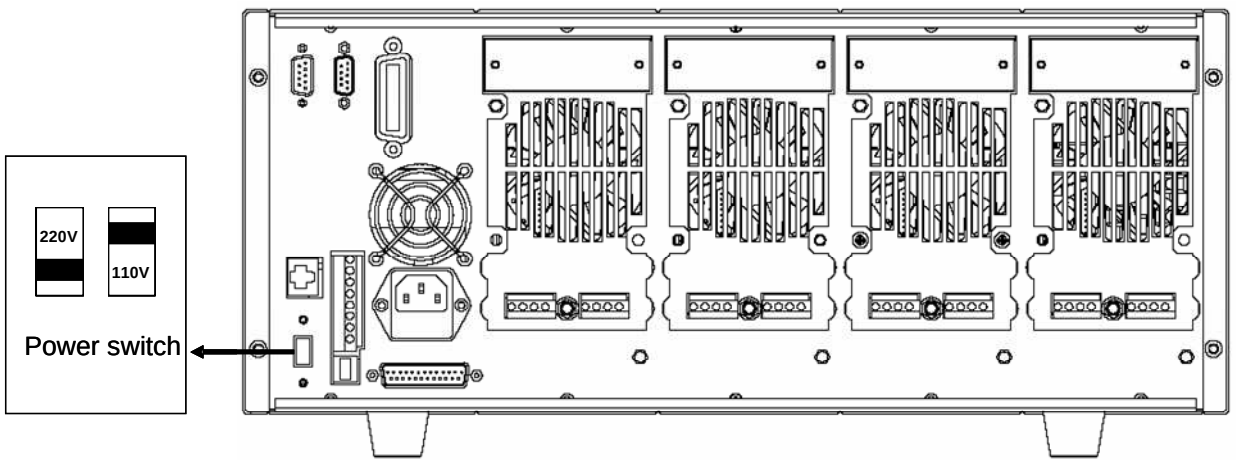


Figure 3-2 power switching keys

3.3 Turn-on checkout

When you turn on the electronic load, the front-panel display will light up briefly while the electronic load perform its power-on self-test. The following table show the procedure of the self-test.

Procedure	Mainframe VFD display	Describe
When powered on	**BOIS Ver 1.00**	VFD display software version
about 1S later	**SYSTEM SELF TEST**	system self-check

about 1S later	**CH1/2/3/4/5/6/7/8 SCAN…** **□7□5□3□1**	detect all modules installed
about 1S later	**e.g.: CH01 CV OFF** **Vdc=0.0000V** **Adc=0.0000A** **Wdc= 0.00W**	Display information of channel 1 or the leftmost channel. Use up and down key to select other channels.

WARNING: The electronic load is shipped from factory with a power cord that has a plug appropriate for your location. Your electronic load is equipped with 3-wire grounding type power cord; the third conductor being ground. The electronic load is grounded only when the power-line cord is plugged into an appropriate receptacle. Do not operate your power supply without adequate cabinet ground connection.

3.4 If the electronic load does not turn on

Use the following steps to help solve problems you might encounter when turning on the instrument:

1) Verify that there is AC power to the power supply.

First, verify that the power cord is firmly plugged into the power receptacle on the rear panel of the electronic load. You should also make sure that power source you plugged the electronic load into is energized. Then, verify that the electronic load is turned on.

2) Verify the power-line voltage setting.

The line voltage is set to the proper value for your country(110VAC or 220VAC) when the electronic load is shipped from facory. Change the line voltage setting if it's not correct.

3) Verify that the correct power-line fuse is installed.

If fuse is blowout, please replace it according to the following specification.

Product	Fuse specification (110VAC)	Fuse specification (220VAC)
IT8702	T5A 250V	T3.15A 250V
IT8703	T5A 250V	T3.15A 250V

4) The method to replace fuse

Use a flat-bladed screwdriver to open the small plastic cover under the AC input connector on the rear panel of the load ,then you can see the fuse. Please use the matching fuse.（figure2-6 shows the fuse location）

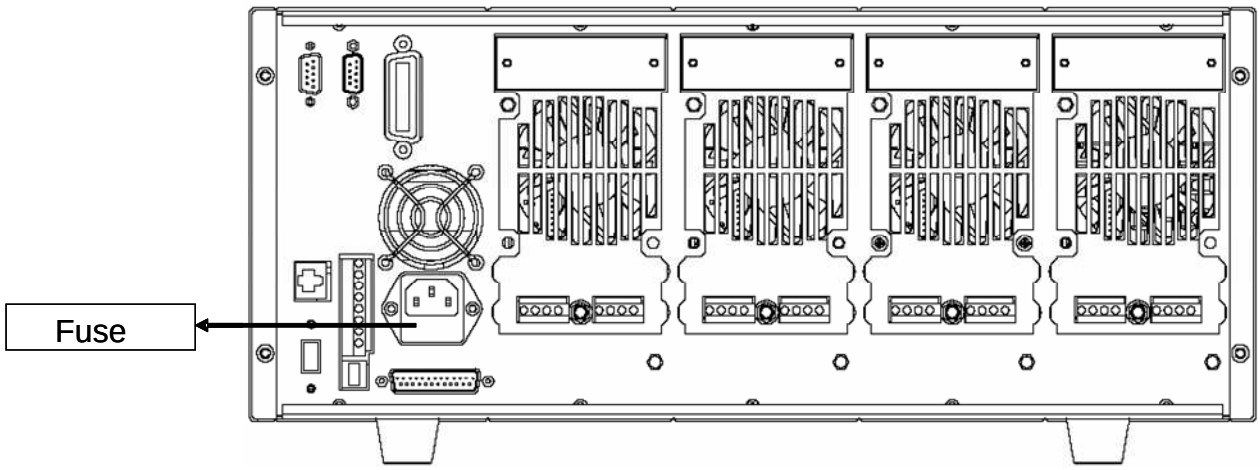


Fig 3-3 fuse location

Chapter4 Technical specification

4.1 Main technical parameters

Model		IT8711		IT8712	
Rated value (0 ~ 40 ℃)	Input voltage	0~80V		0~80V	
	Input current	0~4A	0~40A	0~6A	0~60A
	Input power	200 W		300W	
	Min operation voltage	0.14V at 4A	1V at 40A	0.14V at 6A	1.4V at 60A
CV mode	range	0~80V		0~80V	
	Resolution	1mV		1mV	
	accuracy	±(0.05%+0.02%FS)	±(0.05%+0.025%FS)	±(0.05%+0.02%FS)	±(0.05%+0.025%FS)
CC mode	range	0~4A	0~40A	0~6A	0~60A
	Resolution	0.1mA	1mA	0.1mA	1mA
	accuracy	±(0.05%+0.05%FS)	±(0.05%+0.05%FS)	±(0.05%+0.05%FS)	±(0.05%+0.05%FS)
CR mode	range	0.05Ω~18Ω	18Ω~7.5KΩ	0.05Ω~18Ω	18Ω~7.5KΩ
	Resolution	16bit	16bit	16bit	16bit
	accuracy	0.01%+0.08S	0.01%+0.0008S	0.01%+0.08S	0.01%+0.0008S
Dynamic mode					
Dynamic mode		CC mode		CC mode	
	T1＆T2	10uS~16383S/Res:1uS		10uS~16383S/Res:1uS	
	accuracy	5uS+100ppm		5uS+100ppm	
	Rising/falling slope	0.0001~0.25A/uS	0.001~2.5A/uS	0.0001~0.35A/uS	0.001~2.5A/uS
Measuring range					
Readback voltage	range	0~18V	0~80V	0~18V	0~80V
	Resolution	0.1 mV	1 mV	0.1 mV	1 mV

	accuracy	±(0.025%+0.025%FS)	±(0.025%+0.025%FS)	±(0.025%+0.025%FS)	±(0.025%+0.025%FS)
Readback current	range	0~4A	0~40A	0~6A	0~60A
	Resolution	0.01mA	0.1mA	0.01mA	0.1mA
	accuracy	±(0.05%+0.05%FS)		±(0.05%+0.05%FS)	
Protection range					
OPP	≒200W			≒300W	
OCP	≒4.4A	≒44A		≒6.6A	≒66A
OVP	≒82V			≒82V	
OTP	≒85℃			≒85℃	
Specification					
Short-circuit	current（CC）	≒4.4/4A	≒44/40A	≒6.6/6A	≒60.6/60A
	voltage（CV）	0V	0V	0V	0V
	resistance（CR）	35mΩ	35mΩ	35mΩ	35mΩ
Input impedance	120KΩ			120KΩ	
dimension	82*183*573mm			82*183*573mm	
weight	5KG			5KG	
safety	CE			CE	

Model		**IT8732B**		**IT8733**	
Rated value (0 ~ 40 ℃)	Input voltage	0~500V		0~80V	
	Input current	0~3A	0~20A	0~12A	0~120A
	Input power	300 W		600W	
	Min operation voltage	0.7V at 3A	4.5V at 20A	0.18V at 12A	1.8V at 120A
CV mode	range	0~18V	0~500V	0~18V	0~80V
	Resolution	1mV	10mV	1mV	10mV
	accuracy	±(0.05%+0.02%FS)	±(0.05%+0.025%FS)	±(0.05%+0.02%FS)	±(0.05%+0.025%FS)
CC mode	range	0~3A	0~20A	0~12A	0~120A
	Resolution	0.01mA	0.1mA	0.1mA	1mA
	accuracy	±(0.05%+0.05%FS)	±(0.05%+0.05%FS)	±(0.05%+0.1%FS)	±(0.1%+0.1%FS)
CR mode	range	0.25Ω~10Ω	10Ω~7.5KΩ	0.2Ω~10Ω	10Ω~7.5KΩ
	Resolution	16bit		16bit	
	accuracy	0.01%+0.08S	0.01%+0.0008S	0.01%+0.08S	0.01%+0.0008S
Rated value (0 ~ 40 ℃)	Input voltage	300W		600W	
	Input current	10mW		10mW	
	Input power	±(0.2%+0.2%FS)		±(0.2%+0.2%FS)	
Dynamic mode					
Dynamic mode		CC mode		CC mode	
	T1＆T2	20uS~3600S /Res:1u S		20uS~3600S /Res:1u S	
	accuracy	5uS+100ppm		5uS+100ppm	
	Rising/falling slope	0.0001~0.5A/uS	0.001~1A/uS	0.0001~0.25A/uS	0.001~2.5A/uS
Measuring range					

Readback voltage	range	0~18V	0~500V	0~18V	0~80V
	Resolution	0.1 mV	1 mV	0.1 mV	1 mV
	accuracy	±(0.025%+0.025%FS)	±(0.025%+0.025%FS)	±(0.025%+0.025%FS)	±(0.025%+0.025%FS)
Readback current	range	0~3A	0~20A	0~12A	0~120A
	Resolution	0.01mA	0.1mA	0.1mA	1mA
	accuracy	±(0.05%+0.05%FS)		±(0.05%+0.1%FS)	±(0.1%+0.1%FS)
Readback power	range	300W		600W	
	Resolution	10mW		10mW	
	accuracy	±(0.2%+0.2%FS)		±(0.2%+0.2%FS)	
Protection range					
OPP	≒300W			≒600W	
OCP	≒3.3A		≒22A	≒13.2A	≒132A
OVP	≒82V			≒82V	
OTP	≒85℃			≒85℃	
Specification					
Short-circuit	current(CC)	≒3.3/3A	≒22/20A	≒13.2/12A	≒132/120A
	voltage (CV)	0V	0V	0V	0V
	resistance (CR)	≒200mΩ	≒200mΩ	≒15mΩ	≒15mΩ
Input impedance	≒1MΩ			≒300KΩ	
dimension	82*183*573mm			82*183*573mm	
weight	5KG			5KG	
safety	CE			CE	

Model		**IT8731**		**IT8732**	
Rated value (0 ~ 40 ℃)	Input voltage	0~80V		0~80V	
	Input current	0~4A	0~40A	0~6A	0~60A
	Input power	200 W		400W	
	Min operation voltage	0.10V at 4A	1V at 40A	0.15V at 6A	1.5V at 60A
CV mode	range	0~18V	0~80V	0~18V	0~80V
	Resolution	1mV	10mV	1mV	10mV
	accuracy	±(0.05%+0.02%FS)	±(0.05%+0.025%FS)	±(0.05%+0.02%FS)	±(0.05%+0.025%FS)
CC mode	range	0~4A	0~40A	0~6A	1mA~60A
	Resolution	0.1mA	1mA	0.1mA	1mA
	accuracy	±(0.05%+0.05%FS)	±(0.05%+0.05%FS)	±(0.05%+0.05%FS)	±(0.05%+0.05%FS)
CR mode	range	0.05Ω~10Ω	10Ω~7.5KΩ	0.05Ω~10Ω	10Ω~7.5KΩ
	Resolution	16bit	16bit	16bit	16bit
	accuracy	0.01%+0.08S	0.01%+0.0008S	0.01%+0.08S	0.01%+0.0008S
Rated value (0 ~ 40 ℃)	range	200W		400W	
	Resolution	10mW		10mW	
	accuracy	±(0.2%+0.2%FS)		±(0.2%+0.2%FS)	
Dynamic mode					
Dynamic	CC mode			CC mode	

mode	T1＆T2	20uS~3600S /Res:1u S		20uS~3600S /Res:1u S	
	accuracy	5uS+100ppm		5uS+100ppm	
	Rising/falling slope	0.0001~0.25A/uS	0.001~2.5A/uS	0.0001~2.5A/uS	0.001~2.5A/uS
Measuring range					
Readback voltage	range	0~18V	0~80V	0~18V	0~80V
	Resolution	0.1 mV	1 mV	0.1 mV	1 mV
	accuracy	±(0.025%+0.025%FS)	±(0.025%+0.025%FS)	±(0.025%+0.025%FS)	±(0.025%+0.025%FS)
Readback current	range	0~4A	0~40A	0~6A	0~60A
	Resolution	0.01mA	0.1mA	0.1mA	1mA
	accuracy	±(0.05%+0.05%FS)		±(0.05%+0.05%FS)	
Readback power	range	200W		400W	
	Resolution	10mW		10mW	
	accuracy	±(0.2%+0.2%FS)		±(0.2%+0.2%FS)	
Protection range					
OPP	≒200W			≒400W	
OCP	≒4.4A		≒44A	≒6.6A	≒66A
OVP	≒82V			≒82V	
OTP	≒85℃			≒85℃	
Specification					
Short-circuit	current（CC）	≒4.4/4A	≒44/40A	≒6.6/6A	≒66/60A
	voltage（CV）	0V	0V	0V	0V
	resistance（CR）	≒25mΩ	≒25mΩ	≒25mΩ	≒25mΩ
Input impedance	300KΩ			300KΩ	
dimension	82*183*573			82*183*573	
weight	5KG			5KG	
safety	CE			CE	

Model		**IT8733B**	
Rated value（0～40 ℃）	Input voltage	0~500V	
	Input current	0~3A	0~30A
	Input power	500 W	
	Min operation voltage	0.54V/3A	5.4V/30A
CV mode	range	0~18V	0~500V
	Resolution	1mV	10mV
	accuracy	±(0.05%+0.02%FS)	±(0.05%+0.025%FS)
CC mode	range	0~3A	0~30A
	Resolution	1mA	10mA
	accuracy	±(0.05%+0.05%FS)	±(0.05%+0.05%FS)
CR mode	range	0.2Ω~10Ω	10Ω~7.5KΩ
	Resolution	16bit	
	accuracy	0.01%+0.08S	0.01%+0.0008S
Rated value	range	500W	
	Resolution	10mW	

(0 ~ 40 ℃)	accuracy	±(0.2%+0.2%FS)	
Dynamic mode			
Dynamic mode	CC mode		
	T1＆T2	20uS~3600S/Res:1uS	
	accuracy	5uS+100ppm	
	Rising/falling slope	0.0001~0.1A/uS	0.001~1A/uS
Measuring range			
Readback voltage	range	0~18V	0~500V
	Resolution	0.1 mV	1 mV
	accuracy	±(0.025%+0.025%FS)	±(0.025%+0.025%FS)
Readback current	range	0~3A	0~30A
	Resolution	0.01mA	0.1mA
	accuracy	±(0.05%+0.05%FS)	
Readback power	range	500W	
	Resolution	10mW	
	accuracy	±(0.2%+0.2%FS)	
Protection range			
OPP	≒500W		
OCP	≒3.3A		≒33A
OVP	≒510V		
OTP	≒85℃		
Specification			
Short-circuit	current（CC）	≒3.3/3A	≒33/30A
	voltage（CV）	0V	0V
	resistance（CR）	150mΩ	150mΩ
Input impedance	1MΩ		
dimension	82*183*573mm		
weight	5KG		
safety	CE		

Model		**IT8722**			
		Channel 1		**Channel 2**	
Rated value (0 ~ 40 ℃)	Input voltage	0~80V		0~80V	
	Input current	0~3A	0~20A	0~3A	0~20A
	Input power	250 W		250W	
	Min operation voltage	0.15V at 3A	1V at 20A	0.15V at 3A	1V at 20A
CV mode	range	0~18V	0~80V	0~18V	0~80V
	Resolution	1mV	10mV	1mV	10mV
	accuracy	±(0.05%+0.02%FS)	±(0.05%+0.025%FS)	±(0.05%+0.02%FS)	±(0.05%+0.025%FS)
CC mode	range	0~3A	0~20A	0~3A	0~20A
	Resolution	0.1mA	1mA	0.1mA	1mA

	accuracy	±(0.05%+0.05%FS)	±(0.05%+0.05%FS)	±(0.05%+0.05%FS)	±(0.05%+0.05%FS)
CR mode	range	0.05Ω~10Ω	10Ω~7.5KΩ	0.05Ω~10Ω	10Ω~7.5KΩ
	Resolution	16bit		16bit	
	accuracy	0.01%+0.08S	0.01%+0.0008S	0.01%+0.08S	0.01%+0.0008S
Rated value (0 ~ 40 ℃)	Input voltage	250W		250W	
	Input current	10mW		10mW	
	Input power	±(0.2%+0.2%FS)		±(0.2%+0.2%FS)	
Dynamic mode					
Dynamic mode		CC mode		CC mode	
	T1＆T2	20uS~3600S/Res:1uS		20uS~3600S/Res:1uS	
	accuracy	5uS+100ppm		5uS+100ppm	
	Rising/falling slope	0.0001~0.2A/uS	0.001~2A/uS	0.0001~0.2A/uS	0.001~2A/uS
Measuring range					
Readback voltage	range	0~18V	0~80V	0~18V	0~80V
	Resolution	0.1 mV	1 mV	0.1 mV	1 mV
	accuracy	±(0.025%+0.025%FS)	±(0.025%+0.025%FS)	±(0.025%+0.025%FS)	±(0.025%+0.025%FS)
Readback current	range	0~3A	0~20A	0~3A	0~20A
	Resolution	0.01mA	0.1mA	0.01mA	0.1mA
	accuracy	±(0.05%+0.05%FS)		±(0.05%+0.05%FS)	
Readback power	range	100W		250W	
	Resolution	10mV		10mV	
	accuracy	±(0.2%+0.2%FS)		±(0.2%+0.2%FS)	
Protection range					
OPP	≒250W			≒250W	
OCP	≒3.3A		≒22A	≒3.3A	≒22A
OVP	≒82V			≒82V	
OTP	≒85℃			≒85℃	
Specification					
Short-circuit	current（CC）	≒3.3/3A	≒33/30A	≒3.3/3A	≒33/30A
	voltage（CV）	0V	0V	0V	0V
	resistance（CR）	≒50mΩ	≒50mΩ	≒50mΩ	≒50mΩ
Input impedance	300KΩ				
dimension	82*183*573mm				
weight	CE				

4.2 Supplementary characteristics

Storage capacity: 101 sets

Suggested calibration frequency: one time each year

AC input grade:

Option Opt.1: 220V ±10% 50Hz/60Hz
Option Opt.2: 110V ±10% 50Hz/60Hz

Cooling style
fans

Fans control temperature:

Temperature	35℃	50℃	70℃	85℃
Fans status	The first grade	The second grade	The third grade	OTP

Operation environment temperature:
0 to 40 ℃
Storage temperature
-20 to 70 ℃

Using conditions:
Designed for indoor use,the maxmum humidity 80%

Chapter5 Panel function introduction

Introduction

This chapter mainly introduces the functions and operations of front panel keys. It mainly describes the main frame's front panel keyboard operation, single /dual channel module keyboard operation and VFD display.

5.1 Mainframe operation

The frontpanel keys is effective only in the local mode. When the load is powered on, it works in local mode automatically, and then you can select channel number and set parameters such as voltage, current via the front panel keys. When the load is repowered on, the mainframe will scan all the installed modules once again, and can recall the parameters of the last power off.

5.1.1 Mainframe keyboard functions introduction

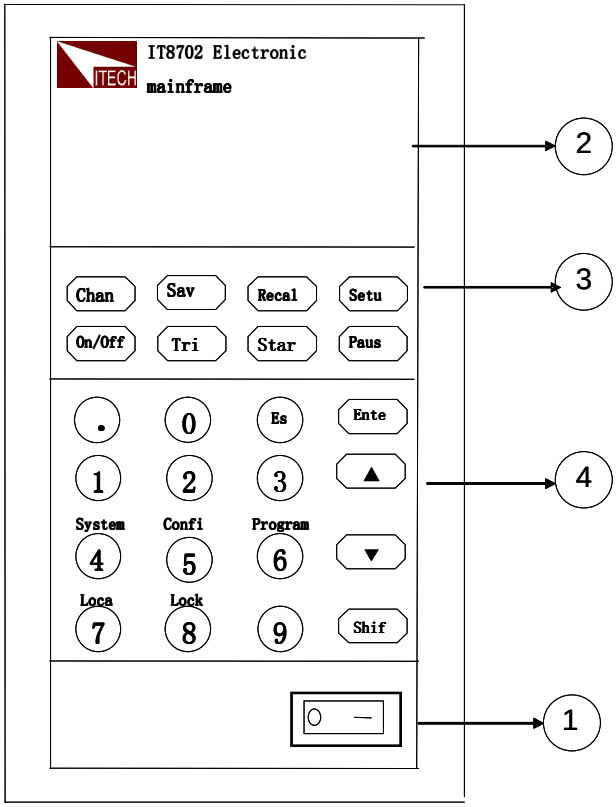


Fig 3-1 IT8702 mainframe front panel

① Power switch: turn the electronic load on and off. Connect the load with 110/220V voltage correctly, press the POWER button, all the front panel will light up briefly while all the channels perform the power-on self-test.

② VFD display: press the POWER key, the VFD screen lit, and shows the version number of this instrument's BOOT software, about 1S later, the system begin to self-test, after about 1S, check all the installed modules of the load, and display every channel's number, voltage and current measurements.

③ Function keys: the following are the detailed description about the functions and specific operations achievable of all the keys. Switch channel via Chan key: IT 8700 is a muti-load, one main frame controls all modules. Every module has its own channel number, select the channel to be edited on the main frame panel first, then start to edit, e.g. if you want to edit the 5th channel, press Chan key first, the VFD will show all the installed channels, press number key 5 directly to switch to 5 channel, now the channel can be edited .

Save key is used to save data: after selecting the channel, edit its parameters, set work mode, voltage, current, Slope, the dynamic parameters and so on. Press Save key to save, up to 101 groups of parameters can be saved. All the parameters are saved in the Non-volatile memory, support power-off saving.

Recall key is used to recall data: Recall key can be used to fast recall the saved 101goups parameters. All the used parameters are only need to be edit and save for one time, they will be always saved in the EPROM. You just need to recall them if necessary. It brings great convenience to the users, and save time.

Setup key is used to enter the specific channel's menu: press this key, you can achieve A/B transient mode, CC/CV/CR mode and so on, this menu has been introduced in detail in the menu list.

On/Off key is used to control module's input state on/off: when you enabled the synchronization function in the menu of a channel, the key can correspondly control the on/off state of the channel.

Trig key is used to trigger: when you edit the auto test file or the transient output, you should select the triggering source, this load have 5 kinds triggering mode, panel triggering is only one of them. It will be introduced in detail in the front panel triggering operation chapter.

Start key is used to start automatic test: after recalling the edited automatic test file, press Start key to start automatic test.

Pause key is used to pause: only press Pause key to pause when running a automatic test, at this time the VFD will display pausing at a step, press Pause key once again to test the file continuously.

④ Comprehensive key+0 ~ 9 number keys: 0 ~ 9 are number input keys; Shift +4/5/6 key will respectively enter 3 menu, it has been introduced in detail in the menu list; if the load is in remote sense mode, press Shift+7 key can switch to local mode; Shift +8 key can lock module's panel keyboard and knob, re press them can unlock it; Esc exit key, can be used to exit any working state; • key means a point; ▲ key is used to move up, select the menu; ▼ key is used to move down, select the menu; Enter key is used to confirm; Shift key is a Comprehensive key.

5.1.2 Menu list

■ Setting menu

Press Setup key to enter menu setting, view the menu in VFD and use ▲ and ▼ to scroll through the completely menu list as following. press Enter key to enter the selected menu function, use ▲ and ▼ to scroll through the VFD screen, press Enter key to enter the under submenu, press Esc back to the previous menu selection page. Pressing number keys can directly select a channel.

Setup menu list of IT8711/IT8712 module:

SET UP		
MODE	Select working mode	
	CONST CURRENT	Load works in CC mode
	CONST VOLTAGE	Load works in CV mode
	CONST RESISTANCE	Load works in CR mode

RANGE(CC/CR)	Switch the range	
	HIGH RANGE	
	LOW RANGE	
I / V / R SET	Set the working current/voltage/resistance value	
∫=2.500A/uS	Set the up slope	
∫=2.500A/uS	Set the down slope	
TRAN A=0.00A	Setup level A value	
Ta=0.0005S	Setup level A width	
TRAN B=0.00A	Setup level B value	
Tb=0.0005S	Setup level B width	
T MODE	Setup the transient mode	
	CONTINUOUS	Continuous mode
	PULSE	Pulse mode
	TOGGLE	Toggle mode
Vmax=82.000V	Setup the maximum voltage value	
Vmin=0.000V	Setup the minimum voltage value	

Setup menu list of IT8732B/IT8733/IT8733B/IT8731/IT8732:

SET UP		
MODE	Select working mode	
	CONST CURRENT	Load works in CC mode
	CONST VOLTAGE	Load works in CV mode
	CONST RESISTANCE	Load works in CR mode
	CONST POWER	Load works in CW mode
	CONST IMPEDAN	Load works in CZ mode
CC/CV RANGE	Switch the range	
	HIGH RANGE	
	LOW RANGE	
I / V / R /W SET	Set the working current/voltage/resistance value	
Vmax/Amax	Setup the maximum voltage value/maximum current value	
Vmin/Amin	Setup the minmum voltage value/minmum current value	
∫=2.500A/uS	Set the up slope (only CC mode avaliable)	
∫=2.500A/uS	Set the down slope(only CC mode available)	
TRAN A=0.00A	Setup level A value	
Ta=0.0005S	Setup level A width	
TRAN B=0.00A	Setup level B value	
Tb=0.0005S	Setup level B width	
T MODE	Setup the transient mode	
	CONTINUOUS	Continuous mode
	PULSE	Pulse mode
	TOGGLE	Toggle mode
RLC R=7500.0Ω	Setup the resistance value	
RLC L=0uH	Setup the inductance value	
RLC C=10uF	Set the capacitance value	

Setup menu list of IT8722 module:

SET UP	
MODE	Select working mode

	CONST CURRENT	Load works in CC mode
	CONST VOLTAGE	Load works in CV mode
	CONST RESISTANCE	Load works in CR mode
	CONST POWER	Load works in CW mode
	CONST IMPEDAN	Load works in CZ mode
CC/CV RANGE	Switch the range	
	HIGH RANGE	
	LOW RANGE	
I / V / R /W SET	Set the working current/voltage/resistance value	
Vmax/Amax	Setup the maximum voltage value/maximum current value	
Vmin/Amin	Setup the minmum voltage value/minmum current value	
∫=2.500A/uS	Set the up slope (only CC mode available)	
∫=2.500A/uS	Set the down slope(only CC mode available)	
TRAN A=0.00A	Setup level A value	
Ta=0.0005S	Setup level A width	
TRAN B=0.00A	Setup level B value	
Tb=0.0005S	Setup level B width	
T MODE	Setup the transient mode	
	CONTINUOUS	Continuous mode
	PULSE	Pulse mode
	TOGGLE	Toggle mode
RLC R=7500.0Ω	Setup the resistance value	
RLC L=0uH	Setup the inductance value	
RLC C=10uF	Set the capacitance value	

Configuration menu

Press Shift + 5 key to enter the channel configuration menu

Configure menu list of IT8711/IT8712 module:

MENU		
SYNC ON SET	Setup Synchronization ON / OFF function	
	ON〈DEFAULT〉	Turn on synchronization function
	OFF	Turn off synchronization function
VON		
	VON POINT	Set the load's von point
	VON LATCH	Von point latch state, ON /OFF
	EXIT	
METER	Meter function	
	VRANGE SEL.	Select voltmeter's range
	HIGH VRANGE	High voltage range
	LOW VRANGE	Low voltage range
	AUTO	Automatic select
	AMODE SELECT	Select Ammeter mode
	MEASURE ADX	DC current meter
	MEASURE AMAX	Maximum current meter
	SPEED	Select metering speed
	HIGH ACCURARY	High accurary
	SLOW〈26HZ〉	Slow speed

	MEDIUM〈172HZ〉		Medium speed
	FAST〈384HZ〉		Fast speed
	FILTER STATE		Filter function
	ON		enable the filter function
	OFF〈DEFUALT〉		disable the filter function
	FILTER MODE		Filter mode setting
	AVERAGING		Averaging mode
	ADVANCE〈DEF〉		
	AVERAGE CNT		Average cnt setting（2-100）
	EXIT		
PROTECT	Load protecting function		
	MAX POWER SET		Setup hardware power protecting
	ALIMIT STATE		Setup software current protecting state
	ON		Put on
	OFF〈DEFAULT〉		Put off
	ALIMIT POINT		Setup software current protecting value
	ALIMIT DELAY		Setup software current protecting delay
	PLIMIT POINT		Setup software power protecting value
	PLIMIT DELAY		Setup software power protecting delay
	ON TIMER STATE		Setup LOAD ON timer state
	ON TIMER SET		Setup LOAD ON timer time
	EXIT		
LIST			
	FUNCTION MODE		Select Mode
	FIXED		Choose fixed operation mode
	LIST		Choose list operation mode
	RECALL LIST		Recall list operation file
	EDIT LIST		Edit list operation file
	CC LIST		In CC mode ， Edit list testing file
	CV LIST		In CV mode ， Edit list testing file
	CR LIST		In CR mode ， Edit list testing file
EXT. CTR 1 SET	External analog control function		
	ON		Turn on external analog control function
	OFF〈DEFAULT〉		Turn off external analog control function
ABOUT	Module production information		
	IT87XX		Channel production model
	SN: XXXXXXXXXXXX		Channel production serial number
	VER: 1.20		Channel software version
EXIT			

Configure menu list of IT8732B/IT8733/IT8733B/IT8731/IT8732module:

MENU		
SYNC ON SET	Setup Synchronization ON / OFF function	
	ON〈DEFAULT〉	Turn on synchronization function
	OFF	Turn off synchronization function
VON		

	VON POINT	Set the load's von point
	VON LATCH	Von point latch state, ON /OFF
	EXIT	
AVERAGE COUNT	Average count set(2^2-16)	
V AUTORAGE	Auto switching voltage range	
	ON<DEFAULT>	Enable this function
	OFF	Disable this function
PROTECT	Load protecting function	
	MAX POWER SET	Setup hardware power protecting
	ALIMIT STATE	Setup software current protecting state
	ON	Put on
	OFF〈DEFAULT〉	Put off
	ALIMIT POINT	Setup software current protecting value
	ALIMIT DELAY	Setup software current protecting delay
	PLIMIT POINT	Setup software power protecting value
	PLIMIT DELAY	Setup software power protecting delay
	ON TIMER STATE	Setup Load ON timer state
	ON TIMER SET	Setup Load ON timer time
	EXIT	
LIST		
	FUNCTION MODE	Select Mode
	FIXED	Choose fixed operation mode
	LIST	Choose list operation mode
	RECALL LIST	Recall list operation file
	EDIT LIST	Edit list operation file
	HIGH RANGE	In CC mode ， Edit high range of list
	LOW RANGE	In CV mode ， Edit low range of list
CR-LED	Simulate the LED light to test LED power drive（in CR mode）	
	ON	Enable the function（in CR mode,press "setup" to set Vd level）
	OFF	Disable this function
EXT. CTR 1 SET	External analog control function	
	ON	Turn on external analog control function
	OFF〈DEFAULT〉	Turn off external analog control function
REM SENSE SET	Remote measuring	
	ON	Enable remote sense function
	OFF<DEFAULT>	Disable remote sense function
ABOUT	Module production information	
	IT87XX	Channel production model
	SN: XXXXXXXXXXXXX	Channel production serial number
	VER: 1.20	Channel software version
EXIT		

Configure menu list of IT8722 module:

MENU	
SYNC ON SET	Setup Synchronization ON / OFF function

	ON〈DEFAULT〉		Turn on synchronization function
	OFF		Turn off synchronization function
VON			
	VON POINT		Set the load's von point
	VON LATCH		Von point latch state, ON /OFF
	EXIT		
AVERAGE COUNT	Average count set(2^2-16)		
V AUTORAGE	Auto switching voltage range		
	ON<DEFAULT>		Enable this function
	OFF		Disable this function
PROTECT	Load protecting function		
	MAX POWER SET		Setup hardware power protecting
	ALIMIT STATE		Setup software current protecting state
		ON	Put on
		OFF〈DEFAULT〉	Put off
	ALIMIT POINT		Setup software current protecting value
	ALIMIT DELAY		Setup software current protecting delay
	PLIMIT POINT		Setup software power protecting value
	PLIMIT DELAY		Setup software power protecting delay
	ON TIMER STATE		Setup Load ON timer state
	ON TIMER SET		Setup Load ON timer time
	EXIT		
LIST			
	FUNCTION MODE		Select Mode
		FIXED	Choose fixed operation mode
		LIST	Choose list operation mode
	RECALL LIST		Recall list operation file
	EDIT LIST		Edit list operation file
		HIGH RANGE	In CC mode ， Edit high range of list
		LOW RANGE	In CV mode ， Edit low range of list
CR-LED	Simulate the LED light to test LED power drive（in CR mode）		
		ON	Enable the function（in CR mode,press "setup" to set Vd level）
		OFF	Disable this function
EXT. CTR 1 SET	External analog control function		
	ON		Turn on external analog control function
	OFF〈DEFAULT〉		Turn off external analog control function
REM SENSE SET	Remote measuring		
	ON		Enable remote sense function
	OFF<DEFAULT>		Disable remote sense function
ABOUT	Module production information		
	IT87XX		Channel production model
	SN: XXXXXXXXXXXXX		Channel production serial number
	VER: 1.20		Channel software version
EXIT			

System menu

Press Shift + 4 key to enter system menu function

MENU			
INITIALIZE			
	INITIAL DEFAULT SET	Resume all configuration to default	
POWER ON SET			
	RST〈DEFAULT〉	Set the load's input state to be the default state when power on	
	SAVO	Set the load's input state to be that of SAVE 0 set when power on	
BUZZER SET	Setup the buzzer state		
	ON	enable the function	
	OFF<DEFAULT>	disable the function	
LOADON KNOB	Module knob mode setting		
	UPDATE<DEFAULT>	Real-time Update	
	OLD	No update（when ON/OFF resume the original value ）	
TRIGGER SOUR.	Setup the trigger mode		
	MANUAL〈DEF〉	Manual trigger	
	EXTERNAL	External signal trigger mode	
	HOLD	Trig:IMM available	
	BUS	GPIB bus trigger mode	
	TIMER	Timer trigger	
TIGGER TIMER	Trigger time setting		
	TIGGER TIMER SET	Setup the time of the trigger timer	
COMMUNICATION	Select the port to communicate with a computer		
	RS232〈DEFAULT〉		
	USB TMC-USB488		
	GPIB		
	ETHERNET		
RS232 SET			
	BAUDRATE SET	Setup the communication baud rate	
	4800〈DEFAULT〉		
	9600		
	19200		
	38400		
	57600		
	115200		
	PARITY SET	Setup the communication parity	
	NONE〈DEFAULT〉	None parity	
	ODD	Odd	
	EVEN	Even	
	HANDSHAKE SET	Handshake protocol	
	NONE〈DEFAULT〉		
	CTS/RTS		
	XON/XOFF		

GPIB ADDRESS	GPIB address setting		
	GPIB ADDRESS SET	Setup communication adress	
ETHERNET SET	Ethernet setting		
	GATEWAY SET	Gateway setting	
	IP SET	IP setting	
	MASK SET	Mask setting	
	PORT SET	SOCKET port setting	
	EXIT		
EAPAND MODULE			
	ON	Enable this function	
	OFF<DEFAULT>	Disable this function	
LANGUAGE SET	Production protocol		
	SCPI〈DEFAULT〉	SCPI protocol	
	EXTEND TABLE	Expand SCPI protocol, compatible with others	
ABOUT	Main module production information		
	IT8700	Main frame production model number	
	SN: XXXXXXXXXXXX	Main frame production serial number	
	VER: 1.10	Main frame software version	
EXIT			

Automatic test menu

Press Shift + 6 key to enter the menu function.

PROGRAM	
RUN PROGRAM	Run the testing flie
RECALL PROG	Recall the testing file
EDIT PROGRAM	Edit the testing file
EXIT	

5.1.3 Channel option

There're 3 ways to switch channel: 1) Chan +number key to switch channel. 2) press Chan / ▼ key to switch. 3) when in SETUP menu, you can directly press the number keys to switch.

5.1.4 Save and recall

First select the channel to be edited at the main frame front panel, after having edited, press Save key to save, press 1 numeric key to save to the first goup in location 1. Press Recall key to recall, then press key 1 to recall the file saved earlier.

5.1.5 Configuration menu introduction

Details on each channel menu function. For example, if you don't want the 3 channel to work with other channels Synchronizly, you can switch to channel 3 on the main frame, press Shift + 5 key to enter module configuration menu, VFD views <SYNC ON SET> , press Enter key to enter, setup OFF state. In the same method to setup other functions in the configuration menu.

5.1.6 Module keyboard lock

Press Shift + 8 key to lock all the operation keyboard and knobs of the current channel panel, press Shift + 8 key again to unlock.

5.2 Module operation

IT8700 modules have 2 kinds input: one is single input module, the other is dual-input module. There are 6 keys on the front panel for each module. Bellow are the detail introduction of module panel keys and functions.

5.2.1 Single channel module panel

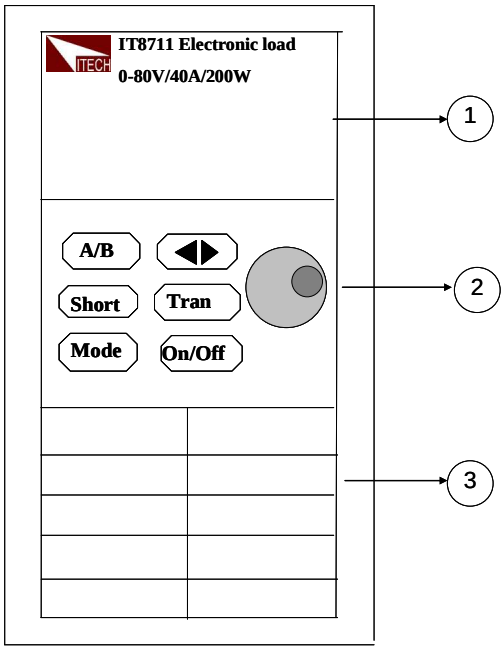


Fig 3-2 single channel module panel

① **Module's panel view:** high-brightness VFD display show module 's working mode.

② **Module's panel keyboard:**

Button	Description
A/B	Switch A/B transient preset value
Short	Realize short testing, allows the load to simulate a short-circuit at the input
Mode	Switch the work mode
◀▶	Move the cursor position. Press ◀▶ key to move the cursor to the position you want to edit, and then use the rotary knob to adjust value**.**
Tran	Select the transient mode, press Tran key first to enable transient mode before running A/B transient operation, and then send the triggering signal to run program.

On/Off	Control module's input state: on/off
	Rotary knob, used to change the setting parameter values

③ **Module's air inlet**

5.2.2 Dual channel module panel

Dual channel module means a module have two channels. Each channel is isolated with the other. setting of the module keyboard can control two channels. The left cannel is channel L, the right channel is channel R.

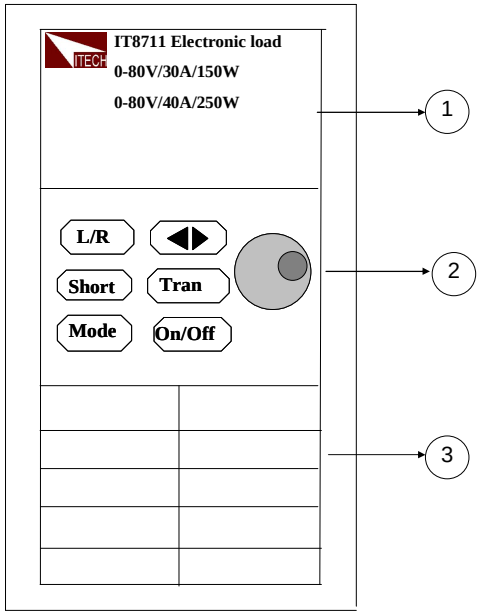


Fig 3-3 dual-channel module front panel

① **Module's panel view:** highlight VFD which display the working state, upper display voltage and current information for channel L; lower displays information for channel R.

② **Module's panel keyboard:**

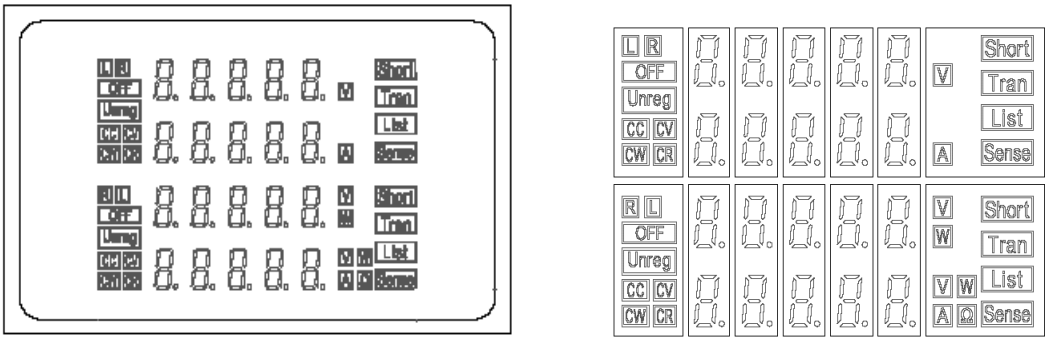
Button	Description
R/L	Switch the left/right channels. Press R/L and to control the two channels.
Short	Realize short testing, allows the load to simulate a short-circuit at the input
Mode	Switch work mode
	Move the cursor position. Press key to move the cursor to the position you want to edit, and then use the rotary knob to adjust value.
Tran	Select the transient mode, press Tran key first to enable transient mode before running A/B transient program, and then send trigger signal to run the program
On/Off	Control module's input state: on/off

	Rotary knob, used to change the setting parameter values

③ **Module's air inlet**

5.3 VFD indicator function description

The detailed introduction of VFD's all indicator functions are as bellow:



3-4 load module VFD panel

1) L/R is the indicator of dual channel module's left/right channel, if you want to edit left/right channel parameters, first select the cannel, L is the left channel; R is the right channel. Single channel module will always display L.

2) OFF indicates that the module input is off, when enable the module input, OFF will turn off.

3) CC/CV/CR/CW/CZ are module's 5 work modes.

4) VFD display screen has 4 lines of number show, the first line shows the current actual voltage value, the second line shows the actual current value, the third line shows the actual circuit's power value, the forth line shows the setup value, users can set A/V/Ω value.

5) Short is lit up ,when the module enables short-circuit function.

6) TRAN is lit up, when the module enables transient mode.

7) LIST is lit up, when select the LIST mode at the configuration.

8) SENSE is enabled in remote meter function, no need to set in the menu, only need to link the circuit according to remote metering, SENSE will be lit up.

5.4 8-pin control connector

IT8700 electronic load 8-pin connector on rear panel（figure 5-5）:

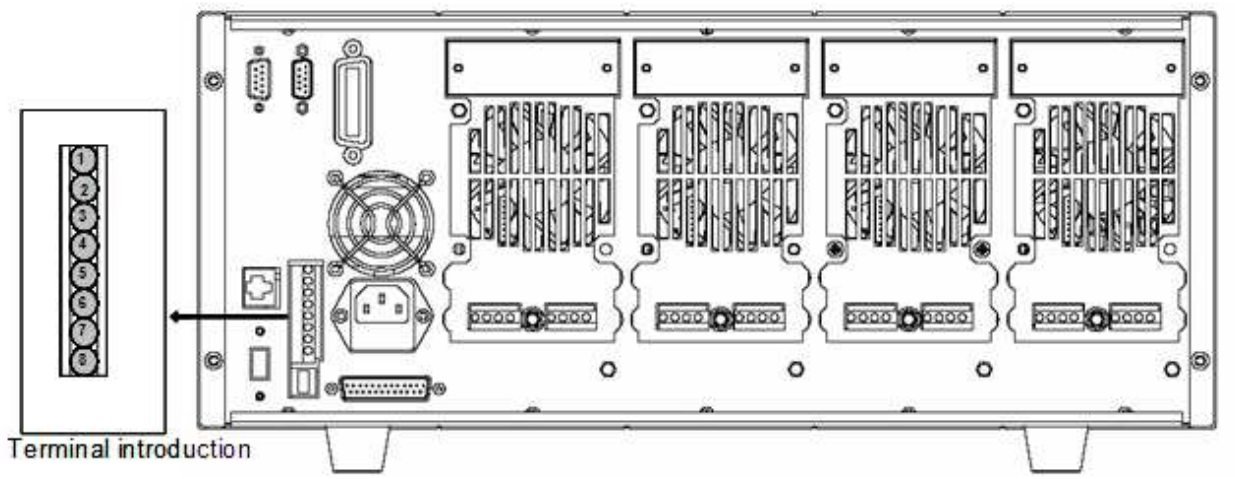


Figure 5-5 IT8700 rear panel 8-pin control connector

1	Trigger IN	trigger signal input
2	Trigger OUT	trigger signal output
3	ON/OFF IN	synchronization ON/OFF control signal input
4	ON/OFF OUT	synchronization ON/OFF signal onput
5	NC	-
6	NC	-
7	GND	Ground
8	GND	Ground

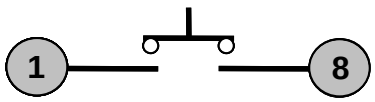
5.4.1 External trigger connections

There're five kinds of trigger mode:1）front panel TRIG trigger mode 2）rear panel trigger mode 3）BUS trigger mode 4）Timer trigger mode 5）trigger HOLD mode

1) When select front panel trigger mode, first set the tigger source as MANUAL, press Trig to start panel trigger mode.

2) When select rear panel trigger mode, first set the tigger source as EXTERNAL, trigger signal input from the 1st pin of 8-pin teminal on the rear panel.

When select external tigger mode, the 1st and 8th send out tigger signal(low pulse is effective), e.g. refer to the below connection figure:



The figure just show one way to produce trigger signal. When press the button, it produce a trigger to change setting value (voltage, current, resistance,etc.),e.g. switch in transient mode, or create pulse in dymatic pulse mode. At the same time , it can ouput trigger signal in pin 2.

3) When select bus trigger mode, first set the trigger source as BUS, connect the electronic load by GPIB or USB or GET communication interface, then if get the *TRIGG command, the load will produce a trigger signal.
4) When select timer trigger mode, first set the trigger source as TIMER, set the TIGGER TIMER's time,the load will produce a singal from time to time.
5) When select hold trigger mode, first set tirrger source as HOLD, the load will produce signal when get the TREG:IMM command.
Pin 2 will output corresponding trigger signal whatever trigger mode you choose.

5.4.2 External ON/OFF control connection

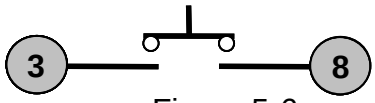


Figure 5-6

ON/OFF IN is used to control the multi-channel to take load or unload synchronizelly. When ON/OFF IN pin receives a low pulse, ON/OFF state of load will reverse. If SYNC ON SET of a specific channel is set ON, then you can use figure 5-6 connection to control its ON/OFF state.
ON/OFF OUT indicates ON/OFF state of multi channels electronic load. If SYNC ON SET of any specific channel is set on, and the channel's input state is on, the pin 4 output low level, otherwise it output high level

5.5 Extended frame connections

The following section introduces extended function of IT8702 mainframe:

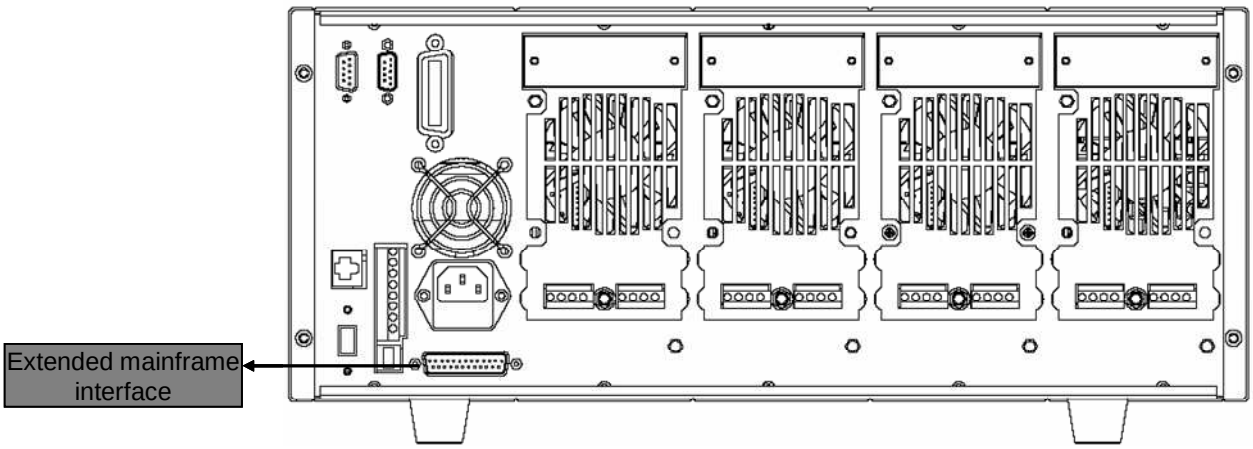


Figure 5-7 Expand interface

This interface can be used to connect extended frame. IT8700 can take up to 16 channels with extended frame.
Procedure: Use expand cable to connect mainframe and expand interface of extended frame. Enable expand function in the menu of IT8702 mainframe by pressing Shift + 4, select "Expand modul", choose ON.

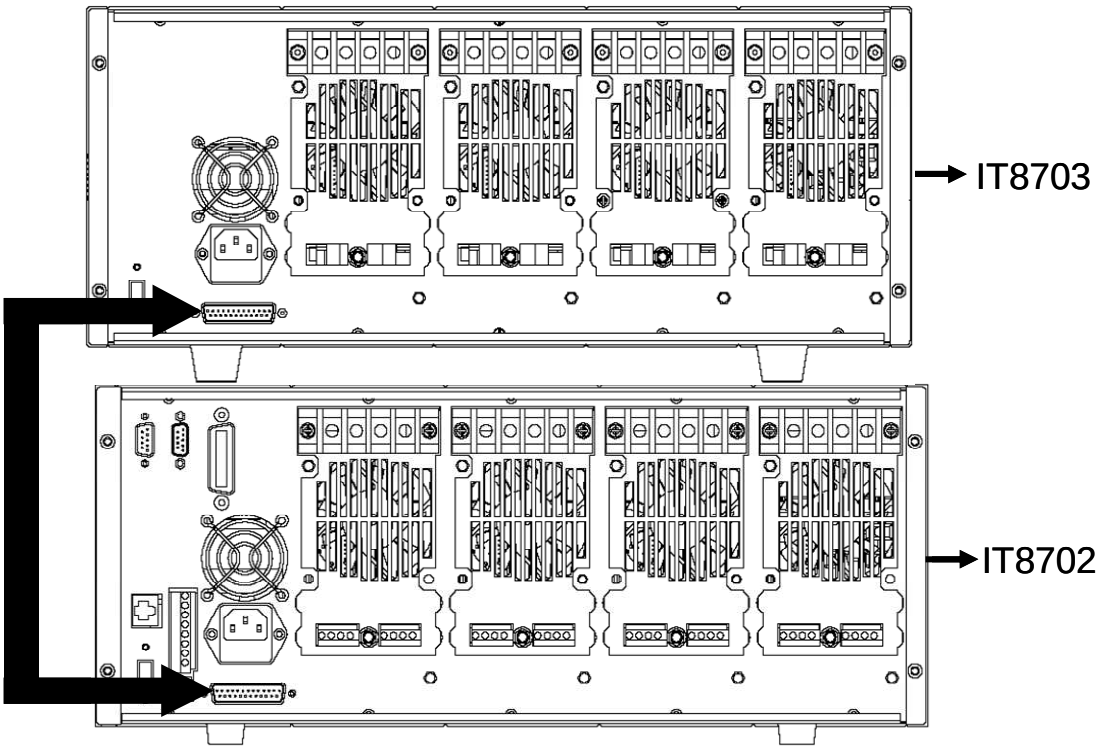


Figure 5-8 Expand connections

5.6 Controlling link

There is a 8-pin connector on every module's rear panel, the following will introduce in detail the 8 pins' specific functions.

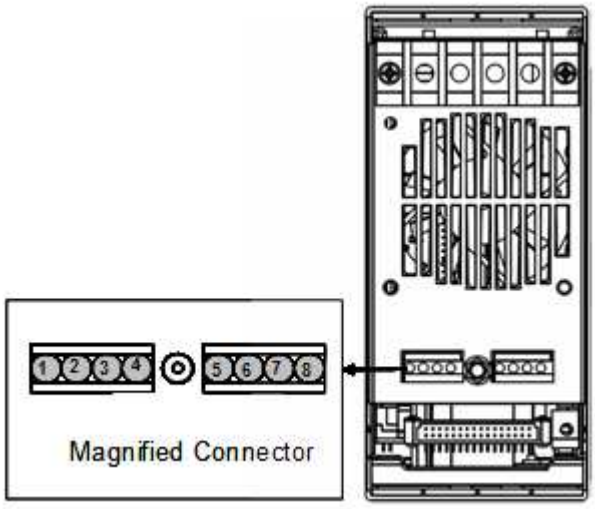


Fig 5-9 terminals on single-channel module rear panel

1	GND	Ground
2	VF	Voltage fault indication terminal
3	DI	Digital input terminal
4	DO	Digital output terminal
◎	I OUT	Current monitoring output
5	SENSE +	Voltage remote measuring terminal(+)
6	SENSE -	Voltage remote measuring

		terminal(-)
7	IN+	External analog controlling terminal(+)
8	IN-	External analog controlling terminal(-)

5.6.1 Voltage failure indication

When the load is under OVP or reverse protection condition, pin 2 VF will output high level signal.

5.6.2 Current monitoring

Current monitoring terminal will output 0-10V analog signal to accordingly on behalf of 0 - full range of input current. You can connect an external voltmeter or a oscilloscope to display the input current's changing.

5.6.3 Digital I/O

Digital I/O is the pin 3 and pin 4 shown in figure 3-14-2, only used in remote control. Pin 4 digital output terminal can output TTL high/low level, it is a universal output terminal, can be used in controlling an external instrument, for example, the relay used in power testing. DI is used to detect the external level state.

5.6.4 Remote measurement connection

Remote Sensing: SENSE (+) and **SENSE (–)** are the remote sensing inputs**.** By eliminating the effect of the inevitable voltage drop in the load leads, remote sensing provides greater accuracy by allowing the load to regulate directly at the source's output terminals.

When load is at CV、CV or CR mode, lead length are relatively long or load regulation is critical, or load consumes high-current, there will be voltage drop in the leads conncted between load and measured object which affect the accuracy of measurement, then the sense connection can be applied. Fig 5-10 illustrate a typical connection between module and device for remote sense operation.

Take single channel module for example, there're two input connectors. One is load input measurement terminal; the other is Vsense measurement teminal. To module IT8711/IT8712,when Vsense is connected to object to be measured, load will switch to Vsense mode automatically (no need to set up in menu). To other modules,you should enable the remote sense function in the configure menu,then connect the remote sense lines.The front panel of the module show "sense".

CAUTION:
The electric potential on the positive terminal of Vsense connector must be higher than negative one.

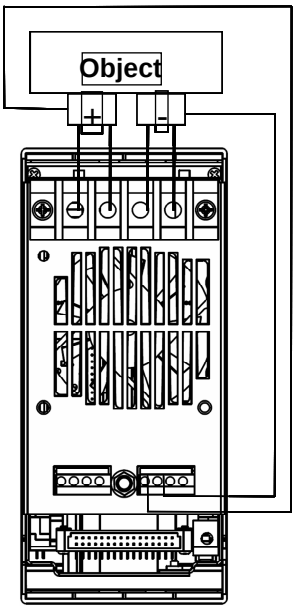


Figure 5-10 Remote sense connection

5.6.5 External analogue control

You can control the voltage and current setting of the electronic load by the analogue terminals: pin 7 and pin 8. 0-10V adjustable analogue simulate the 0-fullscale to regulate the input voltage and current of the electronic load（10V indicate the full range of load voltage or current value）

5.7 Load connection

WARNING:
To safety requirements, load wires bestween the electronic load and the object to be measured should be heavy enough not to overheat while carrying the short-circuit output current.

Before connect object to be measured to load, please remove the cover on the output terminals of the load,and cover it after finished the connection. Please pay attention to the type, length and polarity when wiring. Please avoid using wires of minimum specification of anti superheating which can not supply good load regulation. Generally speaking,if the wires are short enough,they can control voltage drop less than 0.5V. In addition, bonding them together can reduce induction and noise. Please lead wire from positive teminal on the rear panel of module to positive teminal of object. Similarly, connect the corresponding negative teminal. Figure 5-11 illustrates a typical connection of the module with the device to be measured.

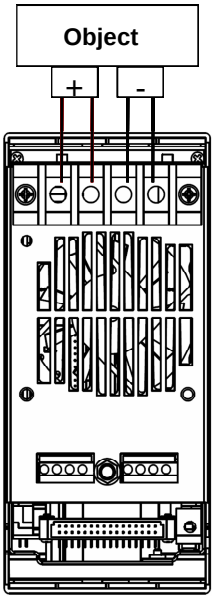


Figure 5-11 connection of load and object

There're two positive terminals and two negative teminals on the rear panel of every moduel. Single teminal connection is adequate when the input current is less than 30A.

WARNING:
To prevent shock hazard, you must install the teminal cover correctly after wiring. Each teminal can carry up to 30A current, double-teminal connection is needed when the input current if more than 30A. (double-terminal connection refer to the above picture.)

5.8 Parallel connections

Parallel connection can be applied between same model modules to increase current and power dissipation, but it can't be applied between different modules. Modules can be paralleled in CC/CR mode,but can't be in CV mode. Each module will dissipate the power it has been programmed for. For example, after being paralleled ,two single channel modules(80V/40A/300W) can dissipate up to 80V/80A/600W. The following picture 5-12 illustrates the paralleled connection for increased power dissipation.

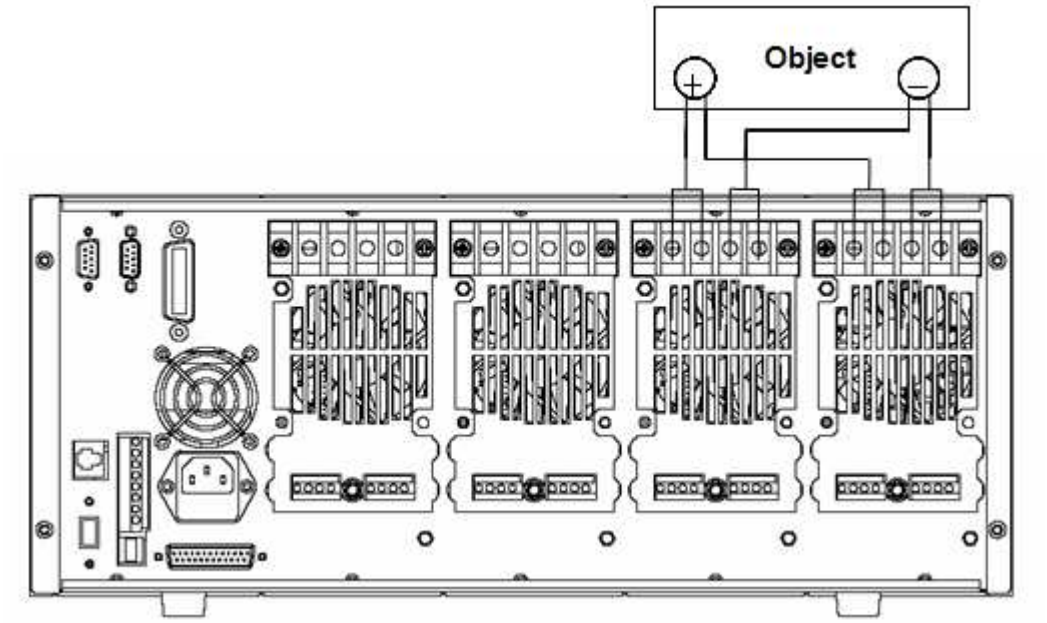


fig 5-12 module parallel connection

Chapter6 Operations introdution

This chapter will mainly introduce IT8700's menu operation function.

6.1 Local/remote operation

The front panel has keyboard controls for setting voltage, current, resistance. Local operation means control the electronic load via the keys on the front panel and the menu operation. Remote operation means control the electronic load through computer via the GPIB、RS232、USB or Ether Net interface.You can press Shift + 7 key to switch between remote control and local control.

6.2 PC control connection

IT8700 series electronic load can achieve remote control via **GPIB /RS232 /USB /ETHERNET**, but only one interface can be used at one time. choose the interface via the system key（**SYSTEM**）. Connect Communication cable before power on. Do not support hot plug, as it may damage communication interface of electronic load. The fowllowing picture shows how to connect RS232 cable between electronic load and PC and show the specific configuration.

Procedure:

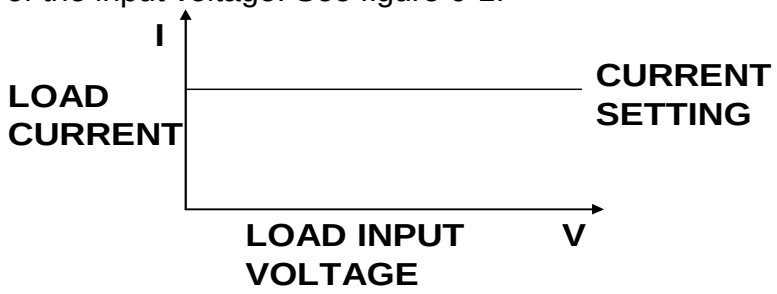
operation	VFDdisplay
1、Conncet RS232 cable	
2、Power on the electronic load	
3、Select channel number via ▼ key, such as channel1	
4、Enter system menu via Shift + 4 key, use ▼ to choose <communication> ,press Enter key to enter ,use ▼ key to choose RS232 ,press Enter key to confirm.	RS232 USB TMC-USB488 GPIB ETHERNET
5、Now Display return to main menu, use ▼ key to choose <RS232> menu, press numeric keys+Enter key to enter. First set <baudrate set>, use ▼ + Enter key to choose and enter; use ▼ key to choose<parity set>, use ▼ +Enter key to choose <none> and confirm ; use ▼ key to choose<Handshake Set>,use ▼ +Enter key to choose<None> and confirm.	BAUDRATE SET PARITY SET HANDSHAKE SET EXIT

6.3 Operating modes

The electronic load can work in the following 3 mode:
1: Constant current operation mode (**CC**).
2: Constant voltage operation mode (**CV**).
3: Constant resistance operation mode (**CR**).
4: Constant power operation mode(**CW**)
5: Constant impedance operation mode(**CZ**)

6.3.1 Constant current (CC) mode

In this mode, the electronic load will sink a current in accordance with the programmed value regardless of the input voltage. See figure 6-1.



CONSTANTCURRENT MODE

Fig 6-1 CC mode

Ranges

When work in CC or CR mode, you can press Setup key to enter the menu, when it show RANGE, you can select either of the two overlapping ranges: <LOW RANGE> or <HIGH RANGE>. Current can be edited in either of the two ranges. Low range will supply higher accuracy and better resolution when you set lower current. If any value you set is outside the maximum value of the LOW RANGE, you should select HIGH RANGE. If the electronic load work in remote control mode（USB / RS232 / GPIB / Ether-net）, you can use CURR**:**RANG command to switch current range.
Caution: when work in CV mode, no range selection function.

Immediate Current value

Set the current level via front panel or sending GPIB command (:CURR <n>), if the load is in CC mode, the new setting current level immediately changes the input at a rate determined by the slew rate. If the load is not in CC mode, the setting current level will be saved for use, until switch to CC mode.

Triggered current level
This function only can be used in remote control mode, when the load is in the CC mode, after receive the CURR:TRIG command, subsequent triggers will have no effect on the input unless another triggering signal is sent. CURR command will cover the CURR:TRIG value, this function is used to synchronize Multi-channel input load changes.

Transient current level
Set A/B transient current level on front panel or by remote operation, the load can continuouly toggle between the two level when transient operation is turned on.

Set slew rate
The current slew rate determines the rate at which the input current to a module changes to a new programmed vaule. You can set current level's rise/fall slew rate on the front panel or by remote operation. The slew rate programmed act in effect to the immediate, triggered and transient current level changes.

6.3.2 Constant resistance (CR) mode

In this mode, the electronic load was equivalent to a constant resistance, as shown below, the electronic load will linearly change the current according to the input voltage. See figure 6-2.

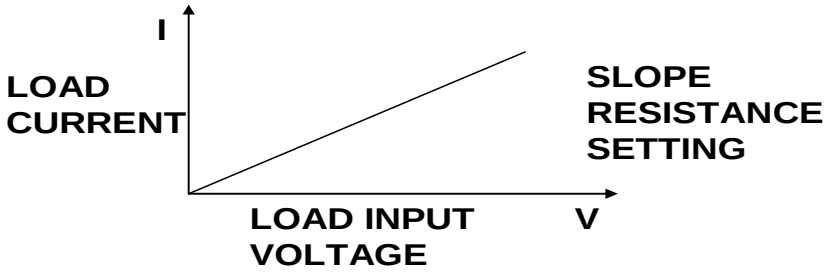


Fig 6-2 CR mode

Ranges
You can select the lower or higer range for CR mode too. when it show RANGE, you can select either of the two overlapping ranges: <LOW RANGE> or <HIGH RANGE>. Resistance can be edited in either of the two ranges. Low range will supply higher accuracy and better resolution when you set lower resistance. If any value you set is outside the maximum value of the LOW RANGE, you should select HIGH RANGE. If the electronic load work in remote control mode（USB / RS232 / GPIB / Ether-net）, you can use RES**:**RANG command to resistance range.

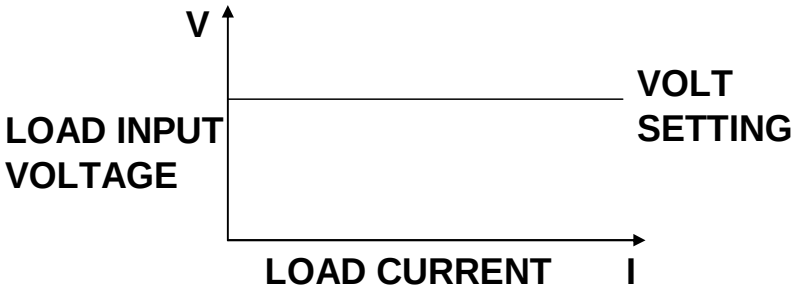
Immediate resistance level
Set the resistance level via front panel or sending GPIB command (:RES <n>), if the load is in CR mode, the new setting resistance level immediately changes the input at a rate determined by the slew rate. If the load is not in CR mode, the setting resistance level will be saved for use, until switch to CR mode.

Triggered voltage level
This function only can be used in remote control mode, when the load is in the CR mode, after receive the RES:TRIG command, subsequent triggers will have no effect on the input unless another triggering signal is sent. RES command will cover the RES:TRIG value, this function is used to synchronize Multi-channel input load changes.

Transient resistance level
Set A/B transient resistance level on front panel or by remote operation, the load can continuouly toggle between the two level when transient operation is turned on.

Set slew rate(IT8711 and IT8712)
The resistance slew rate determines the rate at which the input to a module changes to a new programmed vaule. You can set resistance level's rise/fall slew rate on the front panel or by remote operation. The slew rate programmed act in effect to the immediate, triggered and transient resistance level changes.

6.3.3 Constant voltage (CV) mode
In this mode, the electronic load will attempt to sink enough current to control the source voltage to the programmed value. See figure 6-3.



CONSTANT VOLTAGE MODE

Fig 6-3 CV mode

Ranges
For module IT8711 and IT8712,in CV mode, there is no ranges selecting function.

Voltage level
Set the voltage level on front panel or by sending SCPI command（:VOLT <n）, if the load is in CV mode,the new setting immediately changes the input at a rate determined by the voltage slew rate. If the load is not in CV mode, the set voltage level will be saved in the instrument for use, until switch to CV mode.

Triggered voltage level
This function only can be used in remote control mode, when the load is in the CV mode, after receive the VOLT:TRIG command, subsequent triggers will have no effect on the input unless another triggering signal is sent. VOLT command will cover the VOLT:TRIG value, this function is used to synchronize Multi-channel input load changes.

Transient resistance level
Set A/B transient voltage level on front panel or by remote operation, the load can continuouly toggle between the two level when transient operation is turned on.

Set slew rate(IT8711 and IT8712)
The voltage slew rate determines the rate at which the input voltage to a module changes to a new programmed vaule. You can set voltage level's rise/fall slew rate on the front panel or by remote operation. The slew rate programmed act in effect to the immediate, triggered and transient voltage level changes.

6.3.4 Constant power(CW) mode

In CW mode,electronic load will consume a constant power.As shown in fig6-4,when input voltage increase,the input current will decrease,while power will remain the same.P=(V*I).

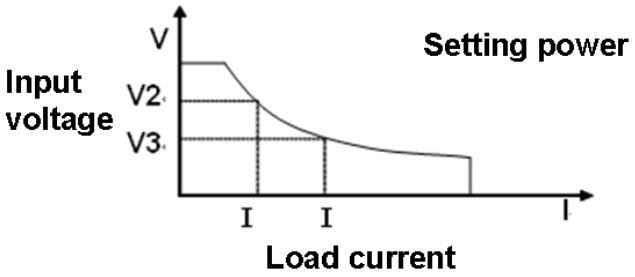


Fig6-4 CW mode

Ranges
You can select the lower or higer range for CW mode too. Power can be edited in either of the two ranges. Low range will supply higher accuracy and better resolution when you set lower power.Any value you set is outside the maximum value of the LOW RANGE, you should select HIGH RANGE.

Immediate power level
You could set the power level via front panel.If the load is in CW mode, the new setting power level immediately changes the input at a rate determined by the slew rate. If the load is not in CW mode, the setting power level will be saved for use until switch to CR mode.

Transient power level
Set A/B transient power level on front panel or by remote operation, the load can continuouly toggle between the two level when transient operation is turned on.

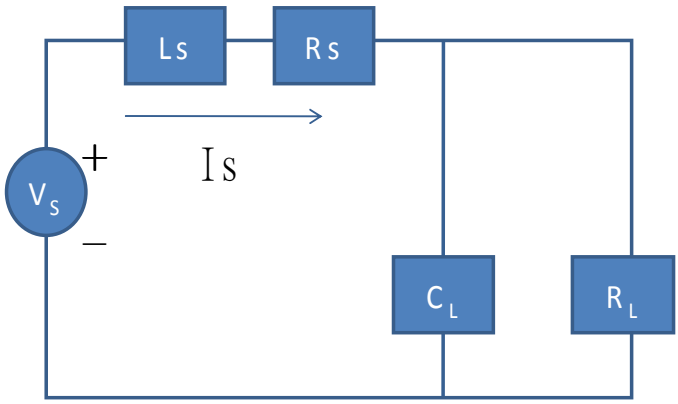
6.3.5 Constant impedance(CZ) mode

Innovative CZ technology using A/D to sample and then build-in DSP calculation processing,to simulate the transient current wave of the tested components.Its internal calculation equation is as follows:

$$I_s(n) = \frac{Y_{L_CR} * (V_S(n) + Z_{LA} * I_S(n-1)) - Y_{CL} * V_O(n-1)}{Y_{L_CR} * (Z_{LA} + R_S) + 1}$$

$Y_{L\text{-}CR}$ represents the shunt conductance of CL and RL
Z_{LA} represents the impedance of LS
Y_{CL} represents the impedance of CL

Circuit principle is as follows:



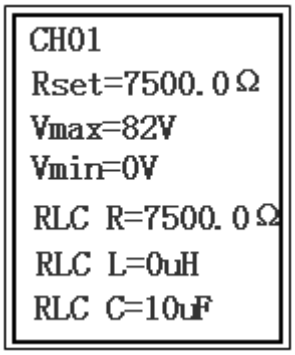
Ranges

You can select the lower or higer range for CZ mode too. Impedance can be edited in either of the two ranges. Low range will supply higher accuracy and better resolution when you set lower impedance.Any value you set is outside the maximum value of the LOW RANGE, you should select HIGH RANGE.

Immediate impedance level

You could set the impedance level via front panel.If the load is in CZ mode, the new setting impedance level immediately changes the input at a rate determined by the slew rate. If the load is not in CZ mode, the setting impedance level will be saved for use until switch to CZ mode.

You should select the channel to be edit before setting.Press SETUP button to enter the CZ mode.After you choose the high-low range,the front panel will display as follows:



Rset=7500.0Ω set the impedance value(R_L)
Vmax=82V set the maximum voltage
Vmin=0V set the minmum voltage
RLC R=7500.0Ω set the series resistance value(Rs)
RLC L=0uH set the series inductance value(Ls)
RLC C=10uF set the parallel captance value(C_L)

Example: R set=11.5Ω，RLC R=1Ω，RLC L=10uH，RLC C=100uF。

6.3.6 Operations

The following will show you how to set operation mode on front panel. Take CC mode as an example:

Operations	VFD display
1、Power on the electronic load	
2、Press ▲ or ▼ keys to select the channel to be edited, such as channel 1	CH01 CC OFF Vdc=0.0000V Adc=0.0000A Wdc=0.00W
3、Press Setup key to enter the channel setup menu, press Enter key to enter the mode selection menu <Mode>, press ▼ key to select the mode CC/CV/CR/CW/CZ, such as CC, press Enter key to confirm	CH01 Mode=CC RANGE=HIGH Iset=9.000A
4、Press ▼ key to enter range selection menu <Range>, press Enter key to enter the mode selection menu <Mode>, press ▼ key to select, such as <low range>, press Enter key to confirm. CC,CR mode have two ranges to all the modules.	CH01 HIGH RANGE LOW RANGE
5、Press ▼ key to enter the current setting <Iset>, such as set the current to be 1.25A, press Enter key to confirm	CH01 Const Current Set= 1.25A
6、Press ▼ key to enter the rise slope setting <∫>, such as set the rise slope to be 1A/uS. Press Enter key to confirm	CH01 Rise Speed Set = 1.00A/Us
7、Press ▼ key to enter the fall slope setting <∫>, such as set the fall slope to be 2A/uS. Press Enter key to confirm	CH01 Fall Speed Set = 2.00A/Us
8、Press Esc key to exit	
9、Press On/Off to open the load's input	CH1 CC ON

6.4 Transient operation

Transient operation enables the module to periodically switch between two load levels, as might be required for testing power supplies. Transient operation can be turned on and off at the front panel (Tran and Trig keys), before you turn on the operation, you should set the parameters associated with transient operation(Setup). The parameters include: A level, A width, B level, B width, and transient testing modes.
The transient testing modes have 3 kinds: continuous, pulsed, or toggled.

Continuous	Generates a respective pulse stream the toggles between two load levels
Pulse	Generates a load change that returns to its original state after some time period
Toggled	Generates a repetive pulse stream that toggles between two load levels. Similar to continuous mode except that the transient points are controlled by explicit triggers instead of an internal transient generator.

6.4.1 Continuous

In this mode, electronic load will generates a repetitive pulse stream that toggles between two load levels. Load could switch the state between two setting value (value A and value B).

In CC mode, transient testing can be used to check the stability of the source voltage. Transient function have two current levels(A level, B level) which should be in the same range (high range or low range). You can set the A/B level delay time and the rise/fall

slew via the main frame keyboard. The slew rate determine the rate which the level changes at. Press Trig key, the load will continuously switch between the A/B levels preset. Transient load are usually used to test the power supply's performance under load continuous changing conditions. Figure 6-6 shows the current waveform of continuous transient operation mode.

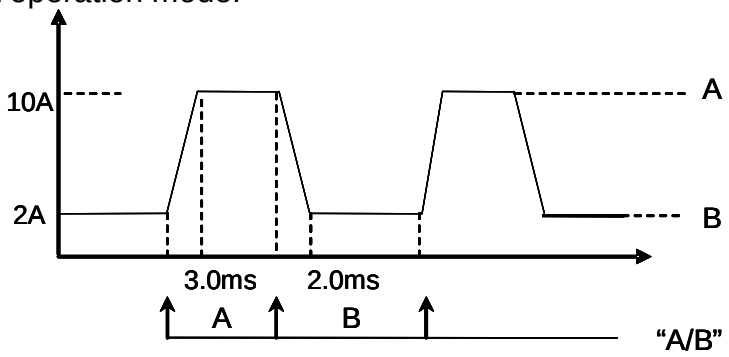


Fig 6-6 continuous transient operation current waveform

6.4.2 Pulsed

In this mode, electronic load will generates a transient pulse of programmable width when pulsed transient operation is in effect.

In pulsed mode, you can set A/B level, A/B width and A/B slew rate via mainframe keyboard. The electronic load will automatically switch to A level, after maintaining A width time, switch to B level, it won't swith to A level until the the instrument receive the pulse signal. The following picture show the current waveform in pulse transient operation.

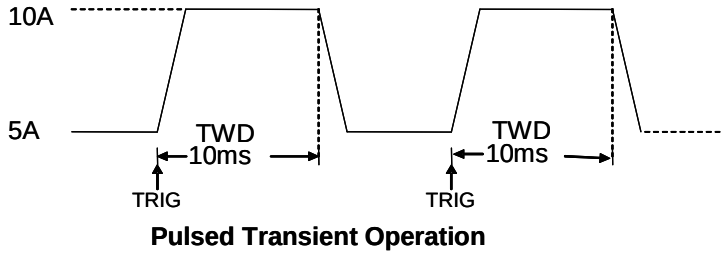


Fig 6-7 pulsed mode current waveform

6.4.3 Toggled

In toggle mode, the electronic load will switch between A level/B level when receiving a triggering signal after the transient operation is enabled. The following picture show the current waveform in toggle transient operation.

Toggled Transient Operation

Fig 6-8 toggled mode current waveform

6.4.4 A/B transient operations

Operations	VFD display
1、Power on the electronic load	
2、Press ▲、▼ keys to select the channel to be edited, such as channel 1	CH01 CC OFF Vdc=0.0000V Adc=0.0000A Wdc=0.00W
3、Press Setup key to enter the channel setup menu, press Enter key to enter the mode selection menu <Mode>, press ▼ key to select the mode CC/CV/CR/CW/CZ，such as CC，press Enter key to confirm	CH01 Mode=CC RANGE=HIGH Iset=9.000A
4、Press ▼ key to enter range setting <Range>, press Enter key to enter the mode selection menu <Mode>, press ▼ key to select, such as <low range>, press Enter key to confirm. CC,CR mode have two ranges to all the modules	CH01 HIGH RANGE LOW RANGE
5、Press ▼ key to enter the current setting <∫>, such as set the current to be 1A/uS，press Enter key to confirm	CH01 Rise Speed Set = 1.00A/Us
6、Press ▼ key to enter the rise slope setting <∫>, such as set the rise slope to be 2A/uS. Press Enter key to confirm	CH01 Fall Speed Set = 2.00A/Us
7、Press ▼ key to enter A LEVEL setting <TRANa>, such as 10.00A, press Enter key to confirm	Transition A Level = 10.00A
8、Press ▼ key to enter A level width setting <Ta>, such as 0.003S，press Enter key to confirm	Tran A Width 0.003S
9、Press ▼ key to enter B level setting <TRANb>, such as 2.00A，press Enter key to confirm	TRAN B = 2.00A
10、Press ▼ key to enter B level width setting <Tb>, such as 0.002S，press Enter key to confirm	Tb = 0.002S
11、Press ▼ key to set transient operation mode	CONTINUOUS

<Tmode>，such as continuous mode, press Enter key to confirm	
12、Press Esc key to exit	
13、Press Shift+4 keys to enter system menu function, press ▼ key to select <Trigger source>，such as select <Manual> on the front panel, press Enter key to confirm	MANUAL EXTERNAL HOLD BUS TIMER
14、press Esc key to confirm	
15、Press On/Off to open the load's input	
16、Press Tran to enable transient operation	
17、Press Trig key to trigger	

If in the remote control mode（USB / RS232 / GPIB / Ether-net）， you can refer to the following example to edit transient operation(refer to IT8700 programming guide to get more).

```
CURRent:TRANsient:MODE CONTinous
CURRent:TRANsient:ALEVel 5
CURRent:TRANsient:AWIDth 0.6mS
CURRent:TRANsent:BLEVel 10
CURRent:TRANsient:BWIDth 0.7mS
TRANsient ON
TRIGger:IMMediate
```

6.5 List operation

List mode lets you generate complex sequences of input changes with rapid, precise timing, which may be synchronized with internal or external signals. This is useful when running test sequences with a minimum amount of overhead.

Generate complex sequences to complete complex tests by editing LIST: Select different trigger resource, editing the step value , width time and slew rate of every step. The parameters of List operation include the name, number of steps(2-255 for IT8711/IT8712 2-255,2-84 for other modules), single step width time(0.000001s~16383s for module IT8711/IT8712,0.000020s~3600s for other modules) and every step's set value and slew rate. The list file can be saved in non-volatile memory, used to fast recall. IT8711 and IT8712 modules can edit up to 6 groups list files . The other modules can edit up to 7 groups list files

Module IT8711/IT8712 has built-in square, sine, triangle, and sawtooth waves.

In list operation mode, the load begin to enable the list operation once receive the trigger signal, until the list operation is completed or the instrument receive another trigger signal.

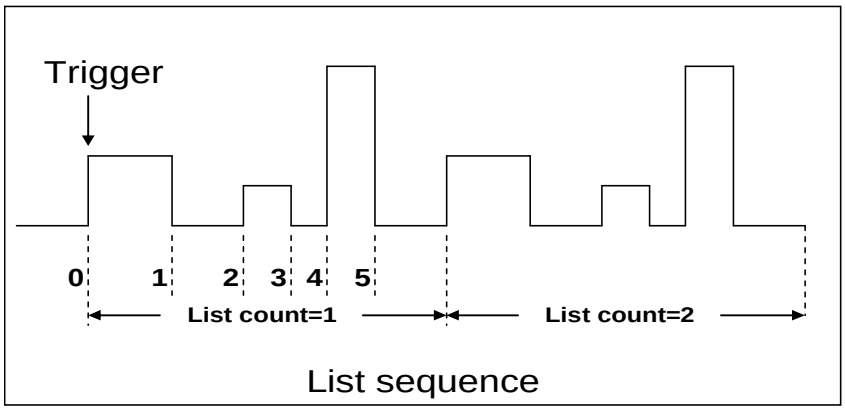


Fig 6-9 List mode current waveform

LIST operation mode

Operations	VFD view
1、Power on the electronic load	
2、Press ▲、▼ keys to select the channel to be edited, such as channel 1	CH01 CC OFF Vdc=0.0000V Adc=0.0000A Wdc=0.00W
3、Press Shift+System keys to enter system menu function, press ▼ key to select <Trigger Source>, such as select <Manual>on the front panel, press Enter key to confirm	MANUAL EXTERNAL HOLD BUS TIMER
4、 Press On/Off to close the load's input	
5、Press Shift+Menu, press ▼ key to select <list>, press Enter key to confirm, press ▼ key to select List<Edit list>, press Enter key to confirm	FUNCTION MODE RECALL LIST EDIT LIST
6、Select list running mode ，such as CC mode, press Enter key to confirm	CC LIST CV LIST CR LIST
7、Select high/low ranges, such as low range, press Enter to confirm	High range Low range
8、Select wave, such as custom wave，press Enter to confirm	Custom wave Sine wave sawtooth
9、Select Lists teps，such as 5 steps，press Enter to confirm	List file step = 5
10、Set the first step's current, such as 1A, press Enter key to confirm	Step 001 level = 1A
11、Set the first step's rise slew rate, such as 1A/uS press Enter key to confirm	Step 001 rate = 1A/uS
12、Set the first step's time, such as 6S. press Enter key to confirm	Step 001 width = 6S
13、 Set the second step's current, such as 0A. press Enter key to confirm	Step 002 level = 0A

14、Set the second step's rise slew rate, such as 1A/uS. Press Enter to confirm	Step 002 rate =1A/uS
15、Set the second step's time, such as 5S. press Enter to confirm	Step 002 width=5S
16、 Set the 3rd to 5th steps in same procedure as 0.5A/ 1A/us /4S, 0A/ 1A/us /2S, 2A/ 1A/us /3S.	……..
17、Select repeat running times, such as 1, press Enter to confirm	Repeat count = 1
18、Select the position to save file, such as 1, press Enter to confirm	CH01 Save list file = 1
19、Press ▲ key to select <function mode>, press Enter key to confirm, press ▲ key to select <list>,press Enter to confirm	Fixed List
20、Press Esc to exit	
21、Press On/Off, open the load's input	
22、Press Trig to trigger	

If in the remote control mode（USB / RS232 / GPIB / Ether-net）, you can refer to the following example to edit list operation (refer to IT8700 programming guide to get more).

```
LIST:MODE CURRent
LIST:RANGe 40
LIST:COUNT 10000
LIST:STEP 4
LIST:LEVEL 1,5
LIST:SLEW 1,2
LIST:WIDTH 1,1
LIST:LEVEL 2,1
LIST:SLEW 2,2
LIST:WIDTH 2,2
FUNCTION:MODE LIST
TRIGger:IMMidiate
```

6.6 Triggered operation

6.6.1 Trigger function

Trigger operation can be used in the following operations: transient pulse output, triggered output and list output. The electronic load have 5 kinds of trigger modes to Synchronously trigger the tested instrument, before enable the trigger function, users should first select trigger source.

6.6.2 Trigger source

keyboard（Trig key）trigger: when the keyboard trigger mode is active, press Trig, will enable a trigger operation.

External trigger signal（TTL level）: the 1st pin of the 8 pins connector on the rear panel of the main frame is trigger input terminal, when external trigger signal is available, input a low pulse（>10uS）to the internal, the load will enable a trigger operation.

Bus trigger: when bus trigger is available, as soon as the load receive a trigger command（GET or *TRG）from the GPIB port, the load will enable a trigger operation.

Timer trigger: when timer trigger is available, the main frame will enable a trigger operation periodly.

Trigger maintenance: when trigger maintenance is available, only when the load receive the trigger command（TRIG:IMM）from the communication port, the load will enable a trigger operation.

6.7 Short operation

The load can simulate a short circuit at its input. During front panel operation, you can press Short key to switch short on/off states. Short operation won't affect the present setting. When turn off the short state, the load returns to the original set state.

The actual value of the electronic in short operation depend on the mode and range active when the short is turned on. In CC,CR mode, the maximum short current is 120% of the current range. In CV mode, short means setting the load's constant voltage to be 0V.

When in remote control mode（USB / RS232 / GPIB / Ether-net）, you can send SCPI command: INPut:SHORt ON to enable the short operation.

6.8 Input on/off operation

In front panel operation conditions, press On/Off key to switch to on/off state. Input on/off operation won't affect the present settings. The load/unload speed of On/off operation is not dependent on the rise/fall slew rate.

When in the remote control mode（USB / RS232 / GPIB / Ether-net）, you can send SCPI command: :INPut ON to open input.

6.9 Synchronous load

To any channels, press Shift + Config key to enter configuration menu, set SYNC ON SET to be ON. When turn on this function, On/Off key can control the input state of the corrspondent module sychronously.

When in remote control mode（USB / RS232 / GPIB / Ether-net）, you can send SCPI command: INPut:ALL ON to synchronously load all channels.

6.10 Von operation

You can set voltage value Von/Voff to control the input state on/off for electronic load. When the input voltage reaches the Von value, the load's input state is on. When the input voltage reaches the Voff value, the load's input state is off.

This function can protect the power supply when the rise/fall speed of it is very low. For example, when you test a power supply's discharging, you can set the start discharge voltage and the terminal discharge voltage of the power supply.

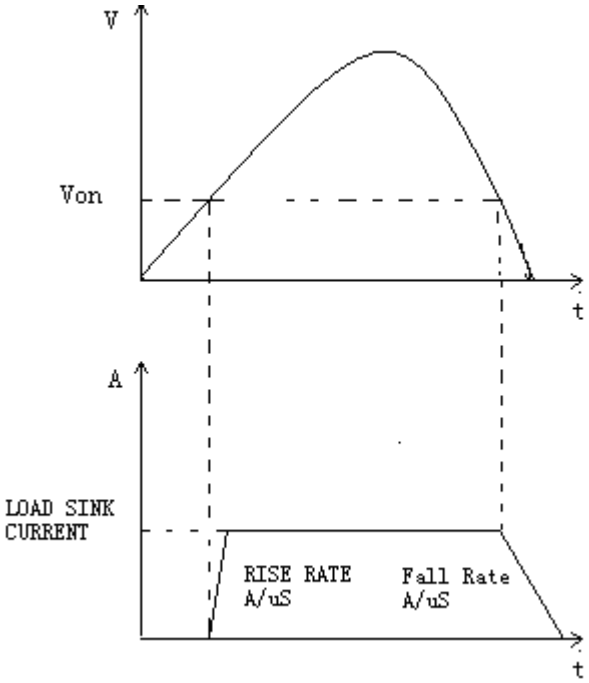


Fig 6-10 VON LATCH load's working range

When disable Von LATCH, voltage rise and is higher than the Von loading voltage, input of electronic load is turned on. When the power supply's voltage fall and is lower than Von unload value, input is turned off.

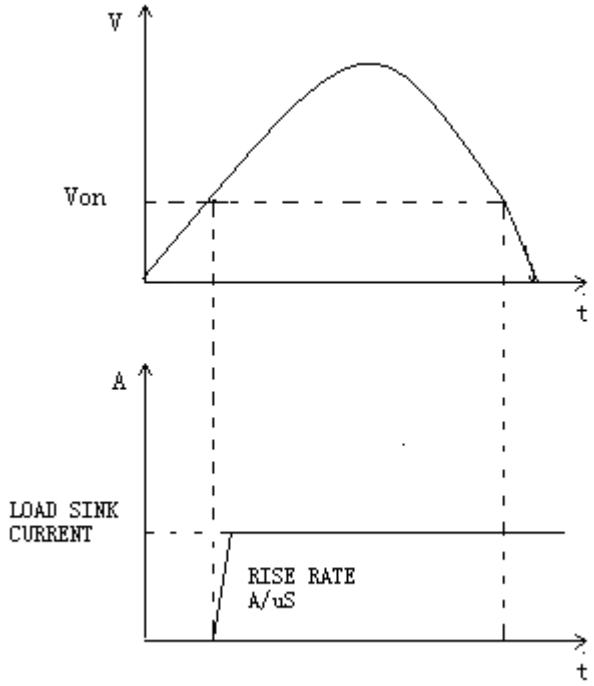


Fig 6-11 VON LATCH load's working range

When enable Von LATCH, voltage rise and is higher than the Von loading voltage, input of electronic load is turned on. When the power supply's voltage fall and is lower than Von unload value, input won't be turned off.

Von function panel operations

Operations	VFD display
1、Power on the electronic load	
2、Select a channel, such as channel 1	CH01 CC OFF Vdc=0.0000V Adc=0.0000A Wdc=0.00W
3、Press Shift + 5 to enter configuration menu	Sync On Set Von Meter
4、Press ▼ to select <Von>, press Enter to enter. First set <Von point>, press Enter key to enter, input the programmed value, such as 1V, press Enter key to confirm	Von point Von Latch Exit
5、Press ▼ to select <Von Latch>, press Enter key to enter, select on/off state, such as On, press Enter key to confirm	
6、Press Esc key to exit	
7、Open the load's input	

When in remote control mode （USB / RS232 / GPIB / Ether-net）， you can send SCPI command :VOLT:ON <n> to set Von value; send :VOLT:LATch ON to enable Von LATCH function.

6.11 Meter(IT8711/IT8712)

6.11.1 Metering operation

Set the meter function appropriatly according to your actural measurement needs.

Press Shift + 5 to enter the setup of meter.

METER	**Range select**		
	VRANGE SEL.	**Voltmeter range select**	
		HIGH VRANGE	**High range**
		LOW VRANGE	**Low range**
		AUTO	**Automatic range**
	AMODE SELECT	**Ammeter mode select**	
		MEASURE ADX	**Measure DC current**
		MEASURE AMAX	**Measure the maximum current**
	SPEED	**Speed select**	
		HIGH ACCURARY	**High accuracy**
		SLOW（26HZ）	**Slow speed**
		MEDIUM（172HZ）	**Medium speed**
		FAST（384HZ）	**Fast speed**
	FILLTER STATE	**Filter function**	
		ON	**Enable filter function**
		OFF（DEFUALT）	**Disable filter function**
	FILLTER MODE	**Setup Filter mode**	

	AVERAGING	Averaging mode
	ADVANCE	
AVERAGE CNT		Setup average cht

Voltmeter select:

There are 3 range for voltmeter: high range, low range, auto range. High/low ranges are dependent on the specific models. Auto range means the load will automatically adjust high/low ranges according to the actual measurement value. To single-channel module IT8711, you can select low range to increase the accuracy when measure input which is lower than 18V. If it's over 18V, you must select high range.

Ammeter select ：

There are 2 kinds of ammeter mode: MEASURE ADX（measure DC current）、MEASURE AMAX（measure max current）.

MEASURE ADX means: when measuring, VFD only display the DC part of the current. The actual value the VFD displays is equal to the ammeter's reading which is the DC part of the circuit; MEASURE AMAX means: when measuring, VFD displays the max current value in the circuit. When the load is simulating short-circuit function, MEASURE AMAX function make you can observe the over shoot current value in.

Speed select:

There are 4 kinds of speeds: HIGH ACCURARY、SLOW<26HZ>、MEDIUM<172HZ>、FAST<384HZ>.

When load is in remote control mode, you can send a query command (for example: MEAS: CURR?) to measure voltage, current and power. When load is addressed to talk, the measurement will be read back. Power is calculated from the voltage and current. Voltage and current are measured simultaneously, so the power value is correct.

All the measurements are performed by digitizing the instantaneous input voltage or current for a defined numbers of samples and sample interval, storing the results in the buffer, and then calculating the measured result. Many measuring parameters are programmable, includes numbers and interval of sampling, and trigger mode. Between these parameters and the measuring speed, accuracy and stability under the present noise there is a tradeoff.

6.11.2 Metering function front panel operation

The electronic load itself has metering function. When it is with load, every channel's actual voltage, current and power will real-time show on the panel.

Measure DC value

Operations	VFD display
1、Power on the electronic load	
2、Select the channel , such as 1	CH01 CC OFF Vdc=0.0000V Adc=0.0000A Wdc=0.00W
3、Measure DC voltage and current, press Shift+5 to select <meter>, press Enter, select <Amode select>, press Enter,	Vrange Sel. Amode Select

select <Adc>, press Enter to confirm. VFD show the present voltage and current readings.	Speed

When in remote control mode, you can send SCPI command to measure (MEAS:VOLT? Or MEAS:CURR?)
The power is calculated from the latest voltage and current value. When in remote control mode, you can send SCPI command to measure: (MEAS:POW？)。

Measure max value

Operations	VFD display
1、Power on the electronic load	
2、Select the channel , such as channel 1	CH01 CC OFF Vdc=0.0000V Adc=0.0000A Wdc=0.00W
3、Measure the max value, press Shift+5, select <Meter>, press Enter, select <Amode select>,press Enter, select Amax, press Enter to confirm	Vrange Sel. Amode Select Speed

When in remote control mode, you can send SCPI command to measure(:CURR:MAX?）

Range select

Operations	VFD display
1、Power on the electronic load	
2、Select the channel , such as channel 1	CH01 CC OFF Vdc=0.0000V Adc=0.0000A Wdc=0.00W
3、IT8700 electronic load have 2 ranges (low range 0-18V, high range: 0-80V). Press Shift+5, select<meter>, press Enter, Select <range sel.>, press Enter to confirm, select your wanted range, such as <Low range>, press Enter to confirm	Vrange Sel. Amode Select Speed

In remote control mode, you can send SCPI command to control (for example CURR:RANG MAX）

6.12 Protection functions

Load has the following protection functions: over voltage protection（OVP）,over current protection（OCP）, over power protection(OPP), over temperature protection(OTP), reverse voltage protection(LRV/RRV）.
The mainframe will act appropriatly once any of the above protection is actived. you can press any button on front panel to restore the protection function. For example, the electronic load come into over temperature protection, the buzzer will alarm, the input will automatically shut down and Main frame VFD will display OTP.

6.12.1 Over voltage protection (OVP)

If the OVP circuit has triggered, buzzer alarm,input will not shut down, the status register's (OV) and (VF) bit is set, the main frame screen will display(OVP), the condition will remain until they are reset. Once over voltage protection occur, the 8 pins connector's VF pin on the rear panel will output TTL high voltage level.

Operations to clear the OVP state

Check whether the input voltage is in the load's rated voltage or the programmed protecting voltage ranges, if it is outside of the range, please disconnect the instrument under test. Press any key on the front panel(or send commandPROTection:CLEar), the (OVP) displayed on the front panel will disappear, load exits OVP protection state.

6.12.2 Over current protection (OCP)

The electronic load includes both hardware and software over current protection features.

Hardware OVP: load's maximum input current will be limited at about 110% of the current range, once the hardware OCP is triggered, the status register's OC bit will be set; when the hardware OCP is removed, the status register's OC bit will be reset. Hardware over current protection won't affect load's on/off state.

Software OCP: users can set load's software OCP value, steps:

Shift + 5 >Protect>Alimit set ON, Apoint set OCP current value, Adelay set delay time before alarm. When the software OCP function is actived, if the load current value is over the over current protection set value, load will automatically off, VFD displays OCP. At the same time, the OC and PS bits in the status register will be set, they will remain until they are reset.

Operations to clear the OCP state

Check whether the input current is within the load's rated current or the programmed protecting current ranges, if it is outside the range, please disconnect the instrument under test. Press any key on the front panel(or send commandPROTection:CLEar), the (OVP) displayed on the front panel will disappear, load exits OCP protection state.

6.12.3 Over power protection (OPP)

The electronic load includes both hardware and software OPP features.

Hardware OPP: the electronic load allows user to set a power protection limit in hardware which will limit the power in the range you set when the OPP condition occur.

Software OPP: users can set load's software OPP value, steps: Shift+5>Protect>Point set OPP power value, Plimit set alarm delay. If the load power value is OPP delay time, load will automatically turned off, VFD will display OPP. At the same time, the OP and PS bits in the status register will be set, they will remain until they are reset.

Operations to clear the OPP state

Check whether the input power is in the rated power range or the programmed protecting ranges, if it is outside the range, please disconnect the instrument under test. Press any key on the front panel(or send commandPROTection:CLEar), the (OPP) displayed on the front panel will disappear, load exits OPP protection state.

6.12.4 Over temperature protection (OTP)

Each module has an overtemperature protection circuit, which will turn off the input if the internal temperature exceeds safe limits. When load's internal circuit temperature is over 85℃, load will enable OTP. Input will automatically turned off, VFD display OTP. At the same time the OT and PS bits in the status register will be set, they will remain until they are reset.

Operations to clear the OTP state

when load temperature dropped to the protecting point, press any key on the front panel(or send command PROTection:CLEar), the (OTP) displayed on the front panel will disappear, load exits OTP protection state.

6.12.5 Reverse voltage protection (LRV/RRV)

This function protects the load module in case the input DC voltage lines are connected with wrong polarity. Once in reverse connection condition, input will be immediately turned off, buzzer alarm, status register's （LRV/RRV）and （VF）bits will be set, main frame screen displays（LRV/RRV）,they will remain until they are reset.
In this condition, the 8 pins connector's VF pin will output a high level.

Operations to clear the reverse voltage state

Check whether the connection is reversed, if so disconnect the object to be meaured.

6.13 Save and recall operation

The stored setting of all channels can be recalled, the stored parameters includes working mode, voltage/ current value, slew rate, transient setting and so on. It can save up to 101 groups of setting parameters. The 0^{th} group can be used as boot parameters. The 1^{st} to 100^{th} groups can be used as automatic testing parameters. All the parameters are saved in the non volatile memory, won't lost even in power down state. You can use SAVE key to save parameters, press RECALL key to fast recall.

Save and recall operations

Operations	VFD display
1、After setting the parameters, press Save key to save, press number 9, press Enter to confirm	Save Group 0
2、Press Recall key , press 9, to recall the saved data	Recall Group 0

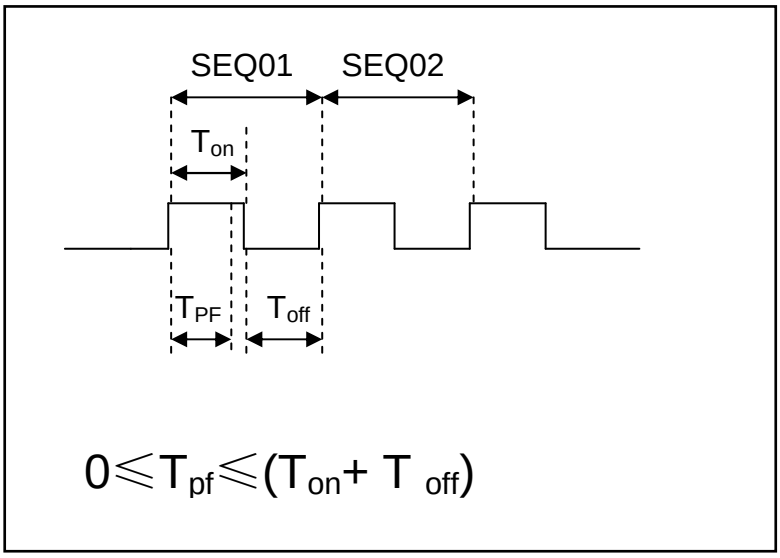
6.14 Automatic test

Automatic test function of IT8700 series electronic load is very powerful, it can simulate various test. It can edit up to 10 groups of testing files, each file has 10 steps, it can edit up to 100 files which can be saved in EEPROM (address).

Edit testing files

Operations	VFD display
1、Power on the electronic load	
2、Press Shift + 6 key to enter the menu	RUN PROGRAM RECALL PROGRAM EDIT PROGRAM

	EXIT
3、 Press ▼ key to move menu to ＞EDIT PROGRAM to edit testing files	
4、Press Enter key to enter the next menu. IT8700 can be max extended to be 16 channels, 0 represent the number of IT8702 main frame, 1 stands for the number of the extended main frame. □7 □5 □3 □1indicater 1/3/5/7 channels have been equipped with loads, next to the main frame is channel 1, the others followed are numbered in order. Press numeric keys to select the channel to be tested, □7□5□3□1changes to □7□Y□Y□1，it stands for 3/5 is selected to be edited. Press Enter to confirm.	ACTIVE CHANNEL 0: □□□□□□□□ 1: □7 □5 □3 □ 1
5、Select the steps needed to test, if you want to test 4 steps, please press in order 1/2/3/4, 0 stands for the tenth step. If you want to cancel a step, press again the numeric0 keys you want to cancel. Press Enter to confirm。	ACTIVE SEQ. 0 9 8 7 6 5 Y Y Y Y
6、In the 4 steps, if you want to suspend, e.g. you want to suspend step 2, press numeric key 2, press Enter to confirm	PASUE SEQUENCE□□□□□□ 4 3 Y 1
7、Edit the 1st step of the 4 steps: determine whether need short circuit testing in channel 3 and 5, for example, channel 3 need short circuit testing, press number 3. press Enter to confirm	SEQ01 SHORT CH0: □□□□□□□□ 1: □□□ 5□Y □□
8、Set with-load time, if you want to load 2S, press numeric key 2, then press Enter to confirm	SEQ01 ON TIME = 2.0 S
9、Set unloading time, if you need 2S, press numeric key 2, then press Enter to confirm	SEQ01 OFF TIME = 2.0 S
10、Set testing delay time, e.g. 1S, press numeric key 1. Tpf is testing delay time.	SEQ01 P/F DELAY TIME = 1.0 S



Tpf is testing delay time

11、Repeat 6）~ 9），set the rest 3 steps' loading/unloading time.	

12、Set the condition when stop testing, COMPLETE mean stop test When all the steps are completed, FAILURE mean stop test when the testing fails. Press ▲ 、 ▼ keys to select, such as <complete>, press Enter key to confirm.	STOP CONDITION > COMPLETE FAILURE
13、Whether you need to link to the next file to be tested, if you need to link to group 2, press number key 2, 0 stands for not linking to other files. Press Enter key to confirm.	PROGRAM CHAIN NO: 1

PROGRAM 1 Sequence	1	2	3	4	5	6	7	8	9	10
Save Group	1	2	3	4	5	6	7	8	9	10
PROGRAM 2 Sequence	1	2	3	4	5	6	7	8	9	10
Save Group	11	12	13	14	15	16	17	18	19	20
:										
:										
PROGRAM 10 Sequence	1	2	3	4	5	6	7	8	9	10
Save Group	91	92	93	94	95	96	97	98	99	100

14、Save the edited files in EEPROM, you can save up to 10 groups of files, e.g please press numeric key 1 to save the edited file in group 1, and then press Enter to confirm.	SAVE PROGRAM NO: 1
15、Press Esc key to exit.	>RUN PROGRAM RECALL PROGRAM EDIT PROGRAM EXIT
16、Select the channel you want to edit, then edit every group's every step, we select channel 3 and channel 5 in above, press ▼ 、 ▲ keys to switch channels, after selecting channel 3.	
17、Press Setup key	> MODE =CC RANGE=HIGH I SET =1.00 A
18、You can edit every step's mode, > MODE =CC, press Enter key to enter the menu, press ▼ 、 ▲ key to select mode, for example, select > Const Current, press Enter to confirm. Press ▼ to select range, for example, RANGE=HIGH, press Enter to enter the menu.	>CONST CURRENT CONST VOLTAGE CONST RESIS.
19、Press ▼ key, move the cursor to > I SET =1.00 A,	CONST CURRENT

press Enter to enter the menu, set the working current, for example, set 1A, press numeric key 1, then press Enter to confirm.	SET = 1.000A
20、Press ▼ to move the cursor to VMAX=82.000V, you need to set the highlimit of testing voltage, press Enter to enter the menu. In this example, the first step is 5.8V, press 5、•、8 keys, then press Enter key to confirm.	VOLTAGE Upper LIMIT = 5.800V
21、 Press ▼ key to move the cursor to VMIN=0.000V, you need to set the low limit of testing voltage, press Enter key to enter the menu. In this example, the first step is 0.15V, press 0、•、1、5 keys, then press Enter key to confirm. After edited the first step of channel 3, press Esc key to exit.	VOLTAGE LOWER LIMIT = 0.150V
22、Press ▼ ▲ keys to select channel 5, in order to select the first step of channel 5, repeat 16）~19）steps, after editing the menu, press Esc key to exit.	
23、Then save the edited first step of channel 3 and channel 5, press Save and numeric key 1to save step 1. in the same way, you can edit the rest 3 steps of channel 3 and channel 5. after saving , press Enter to confirm.	SAVE GROUP 0

Recall testing files

The following way can make you fast recall the edited testing files from EEPROM after re-powering.

Run testing files

Operations	VFD display
1) Press Shift + 6 to enter the menu	RUN PROGRAM RECALL PROGRAM EDIT PROGRAM EXIT
2) Press ▼ to move to <RECALL PROGRAM> to recall the saved testing files.	
3) Press Esc to exit.	
4）Press Start key to start automatic testing, if you need to pause, press Pause key, then press ▼ key to continue	

6.15 CR-LED function

The CR-LED function of IT873X and IT8722,makes it ture that they can simulate the real characteristics of the LED lights when test the LED power drive(constant current source). LED light is usually combined by a number of diodes, but the diodes only works when the voltage reaches the “turn-on voltage” value, more over, usually the ripple of the LED power drive is rather large, so the tranditional CR mode of Eolad can not meet the test of LED constant current source, the fail phenomenon can be: the readback current or voltage lack instability. IT873X and IT8722 modules, with the CR-LED functions can fully simulate the characteristics of the LED lights, you can set Vd value to simulate the diode turn-on voltage characteristics, so that your test is more accurate.

Procedure:

Steps	VFD display
1、power on the E-load	
2、select the channel	
3、Press Shift + 5 to enter COFIG menu of the specified channel	SYNC ON SET
4、 Press ▼ to move to ＞CR-LED, press Enter to enable the function , then prees Enter	ON OFF（Default）
5、Press ESC to escape	
6、Press Setup	MODE= CC
7、Press Enter，selct the working mode as CR by pressing direction key(up and down key)，press Enter	Const Current Const Voltage >Const Resis
8、Press down arrow key until the VFD display >Rset=7500.0，and then set the CR resistance level	Const Resis Set=7500.0 Enter Esc
9、Press down arrow key to >Vd= 0.000V，press Enter to set the Vd value	CR-LED Vdorp= 0.000V Enter Esc
10、Press “ESC” to escape	

Chapter7 Remote operation

There are four kinds of communication interfaces: Ether Net、GPIB、USB、RS232. You can choose any one of them to communicate with PC.

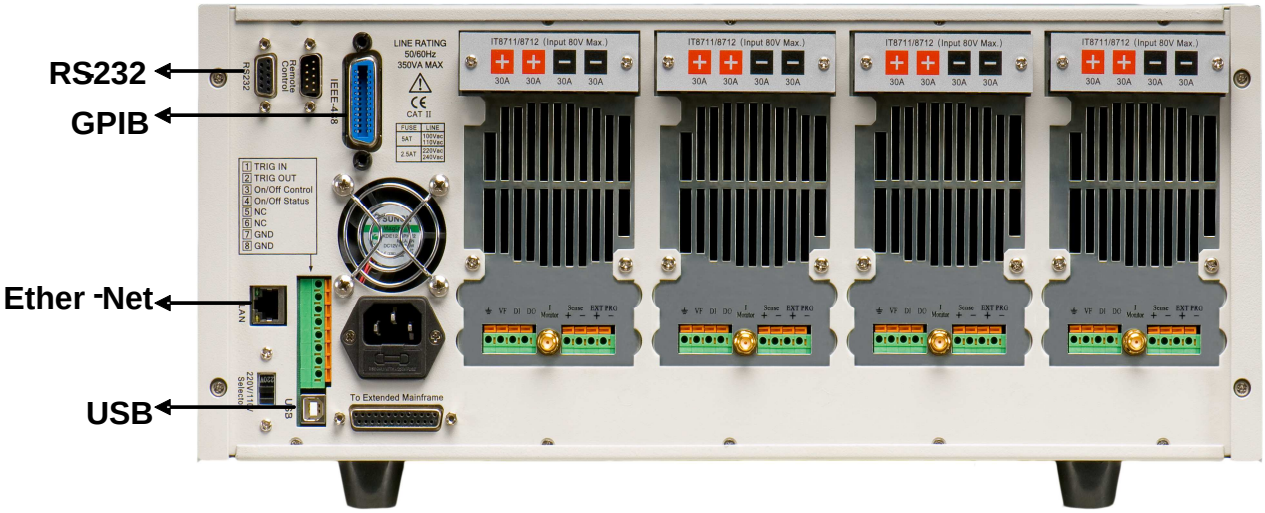


Figure 7-1IT8700 rear panel communication interface

- **Ether Net interface:** use a network cable to connect PC through Ether-net interface of load. Then press Shift +System on the front panel to enter menu,choose <Ether-net>in <communication>item,then set gateway address<Gateway Set>, IP address <IP Set>,mask address <Mask set>,and port< port set> in Ether-net.

- **GPIB interface:** First conncet GPIB port of load to GPIB card of PC. They must be sufficient contact and tighten the screws. And then set address. The address can be set from 0 to 31. Press Shift +System key to enter system menu, press ▼ key to find GPIB address set ,then enter the address,and use Enter to confirm. The electronic load operates from a GPIB address set from the front panel. To set the GPIB address, press the <Shift> + <System>key on the pront panel and enter the address using the Enter key. The GPIB address is stored in non-volatile memory.

- **RS232 interface:** use a cable with two COM interface（DB9）to connect load and PC. It can be activated by <Shift> + <System> key on the front panel. NOTE:There're two COM interface on the rear panel of IT8700: the left 9-pin COM interface is RS232 communication interface; the right 9-pin COM serial port connection（extended keyboard interface）. All SCPI commands are available through RS-232 programming. The EIA RS-232 standard defines the interconnections between data terminal equeipment（DTE）and data communications equipment（DCE). The electronic load is designed to be a DTE. It can be connected to another DTE such as a PC COM port through a null modem cable

NOTE: The RS-232 settings in your program must match the settings specified in the front panel system menu. Press <Shift> + <System>key if you need to change the settings. You can break data transmissions by sending a ^C or ^X character string to the multimeter. This clears any pending operation and discards any pending output.

RS-232 data format

The RS-232 data is a 10-bit word with one start bit and one stop bit. The number ofstart and stop bits is not programmable. However, the following parity options are selectable using the frongt panel<Shift> + <System>kye.
Parity options are stored in non-volatile memory.

Baud rate

The front panel <Shift> + <System>key lets you select one of the following baud rates, which is stored in non-volatile memory:
4800 9600 19200 38400 57600 115200

RS-232 flow control

The RS-232 interface supports the following flow control options that are selected using the front panel <Shift> + <System>key. For each case, the electronic load will send a maximum of five characters after hold-off is asserted by the controller. The electronic load is capable of receiving as many as fifteen additional characters after it asserts hold-off.

- The electronic load asserts its Request to Send (RTS)line to signal hold-off when its input buffer is almost full,and it interprets its Clear to Send (CTS)line as a hold-off signal from the controller.
- When the input queue of the electronic load becomes more than 3/4full,the instrument issues an X-OFFcommand. The control program should respond to this and stop sending characters until the electronic load issues the X-ON,which it will do once its input buffer has dropped below half-full. The electronic load recognizes X_ON and X_OFF sent from the controller. An X-OFF will cause the electronic load to stop outputting characters until it sees an X-ON.
- NONE There's no flow control.

Flow control options are stored in non-volatile memory.

RS-232 connections

The RS-232 serial port can be connected to the serial port of a controller (i.e., personal computer) using a straight through RS-232 cable terminated with DB-9 connectiors. Do not use a null modem cable. Table 2－2 shows the pinout for the connector.

If your computer uses a DB-25connector for the RS-232interface,you will need a cable or adapter with a DB-25 connector on one end and a DB-9 connector on the other,wired straight through(not null modem).

RS-232 connector pinout

pin number	description
1	no connection
2	TXD,transmit data
3	RXD,receive data
4	no connection
5	GND,signal ground
6	no connection
7	CTS, clear to send
8	RTS, ready to send
9	no connection

RS-232 troubleshooting:

If you are having trouble communicating over the RS-232 interface,check the following:

- The computer and the electronic load must be configured for the same baud rate, parity, number of data bits,and flow control options. Note that the eledtronic load is configured for 1 start bit and 1stop bit (these values are fixed).
- The correct interface cables or adapters must be used, as described under RS-232 connector. Note that even if the cable has the proper connectors for your system,the internal wiring may be incorrect.
- The interface cable must be connected to the correct serial port on your computer (COM1, COM2,etc.).

Communication setting

Before communication operation, please make sure that the following parameters of electronic load match that of PC.

Baud rate ：9600(4800、9600、19200、38400、57600、115200). You can enter system menu through panel to set communication baud rate.

1. Data bit ： 8
2. Stop bit ： 1
3. Parity ： (none,even,odd)

EVEN seven data bits with even parity
ODD seven data bits with odd parity
NONE eight data bits without parity

4. Local address ： （0 ~31，default setting is 0）

Parity=None	Start Bit	8 Data Bits	Stop Bit

- **USB interface** ： use cables with double USB interface to connect load and PC. All electronic load functions are programmable over the USB.
  The USB488 interface capabilities of the electronic load are described below:
  - The interface is 488.2 USB488 interface
  - The interface accepts REN_CONTROL, GO_TO_LOCAL, and LOCAL_LOCKOUT requests.
  - The interface accepts MsgID = TRIGGER USBTMC command message and forwards TRIGGER requests to the function layer.

  The USB488device capabilities of the electronic load are described below:
  - The device understands all mandatory SCPI commands.
  - The device is SR1 capable.
  - The device is RL1 capable.
  - The debice is DT1 capable.

When communicating with PC, you can just select one method of all the communication methods above.